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PICATINNY ARSENAL DOVER N J MANAGEMENT INFORMATION S--ETC F/G 9/2  
GRAFTEK - GRAFFIT CURVE FITTING PROGRAM TEKTRONIX VERSION.(U)

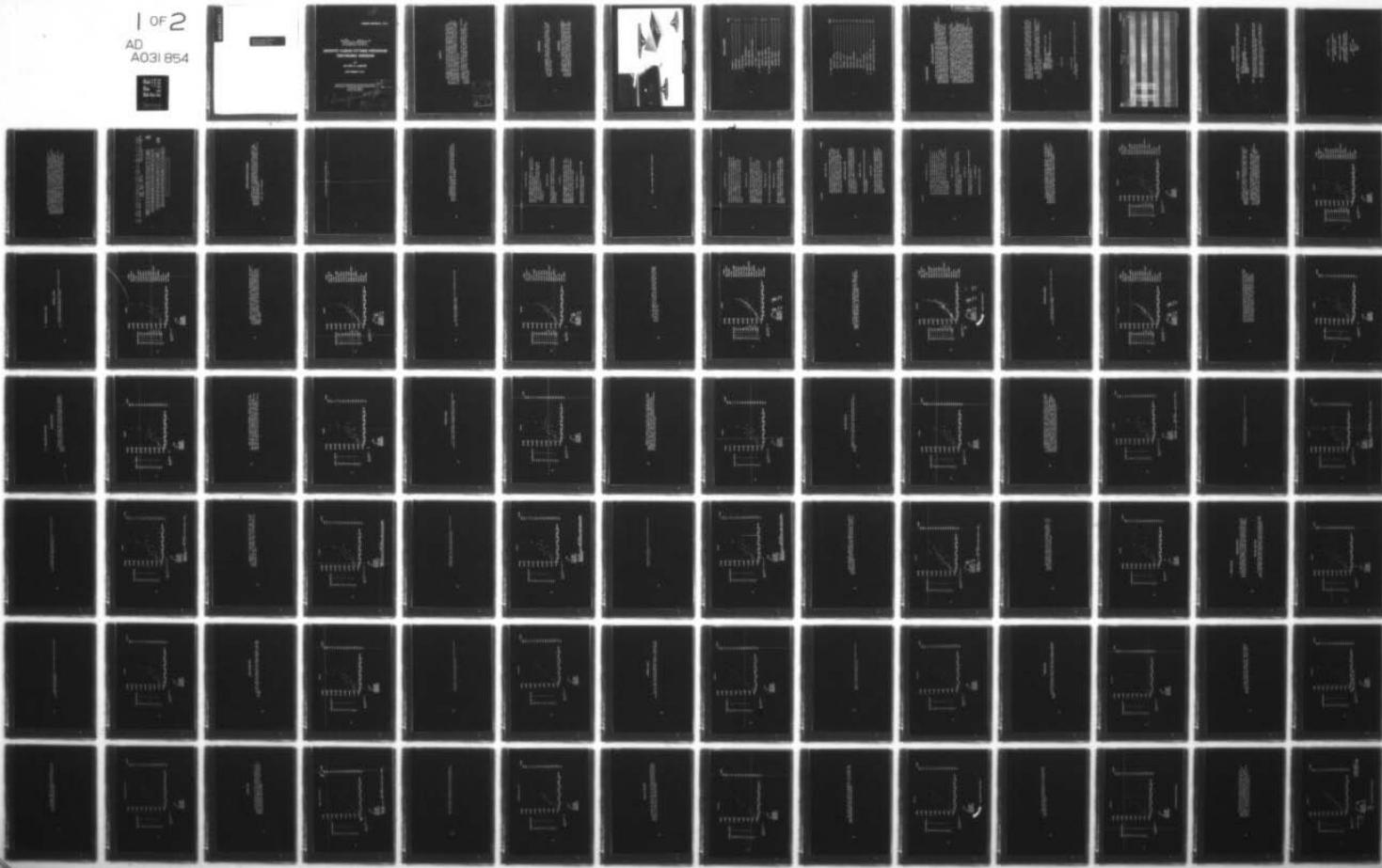
SEP 76 W D LUNGER

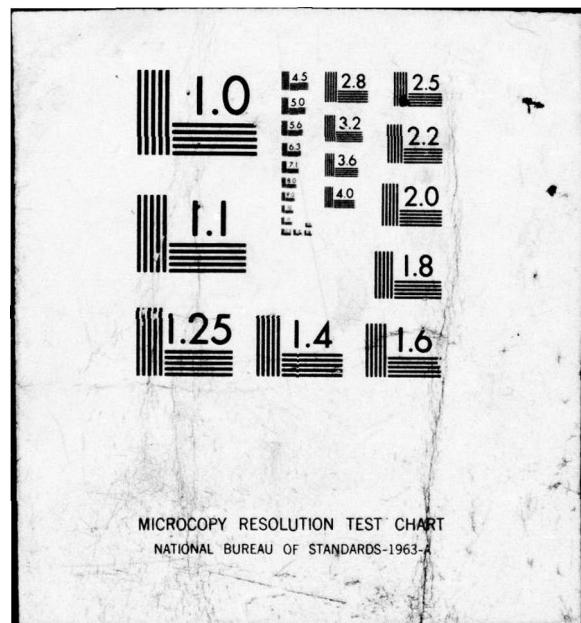
MISD-UM-76-3

UNCLASSIFIED

1 OF 2  
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WHEN NO LONGER NEEDED,  
PLEASE RETURN TO:  
MISD/SEAD/BLDG. 353

(3)

**USERS MANUAL 76-3**

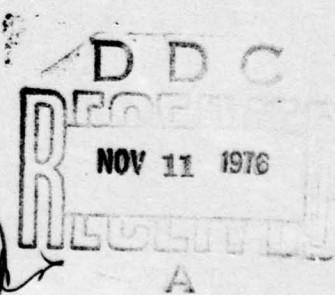
"**Grafitek**"

**GRAFFIT CURVE FITTING PROGRAM  
TEKTRONIX VERSION**

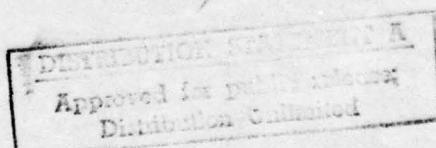
by  
**WAYNE D. LUNGER**

**SEPTEMBER 1976**

SCIENTIFIC & ENGINEERING APPLICATIONS DIVISION  
MANAGEMENT INFORMATION SYSTEMS DIRECTORATE  
PICATINNY ARSENAL  
DOVER, NEW JERSEY



(See form 1473)



ABSTRACT

GRAP-TEK is an interactive graphics program that fits by least squares, a curve to N data points. This code combines two CDC 274 graphics curve fitting programs (GRAFFIT, LSQ) for use on the Tektronix 4014 storage tube using Tektronix software (TCS). The program fits the curve and determines the constants for any of nine empirical equations or a polynomial of up to 11th degree, and displays the fitted curve (up to three at one time) against a background of the data points.

Options include reading in new data, rescale of axes, deleting all displayed curves, deleting points, adding new points, restoring all original or selected deleted points, specifying constants, and calling for CALCOMP plotter or "quick look" hard copy of output.

ACCESSION NUMBER		NAME SYSTEM	<input checked="" type="checkbox"/>
S/N		BIN SECTION	<input type="checkbox"/>
DATA SOURCE			
INITIALIZATION			
BY			
DISTRIBUTION/AVAILABILITY CODES			
DATE	AVAIL. REG. OR SPECIAL		
A			

ASSUMPTIONS

It is assumed that the reader is familiar with the SCOPE and INTERCOM systems at Picatinny Arsenal, Dover, N.J. and that he can successfully prepare a Tektronix terminal for use.

DISCLAIMER

This report is issued for information and documentation purposes only. The authors, MISD, Picatinny Arsenal and Department of the Army are not responsible for the accuracy of the material contained herein; nor is the material presented to be construed as the official position of Picatinny Arsenal or the Department of the Army.

TYPICAL TEKTRONIX GRAPHICS  
CONFIGURATION

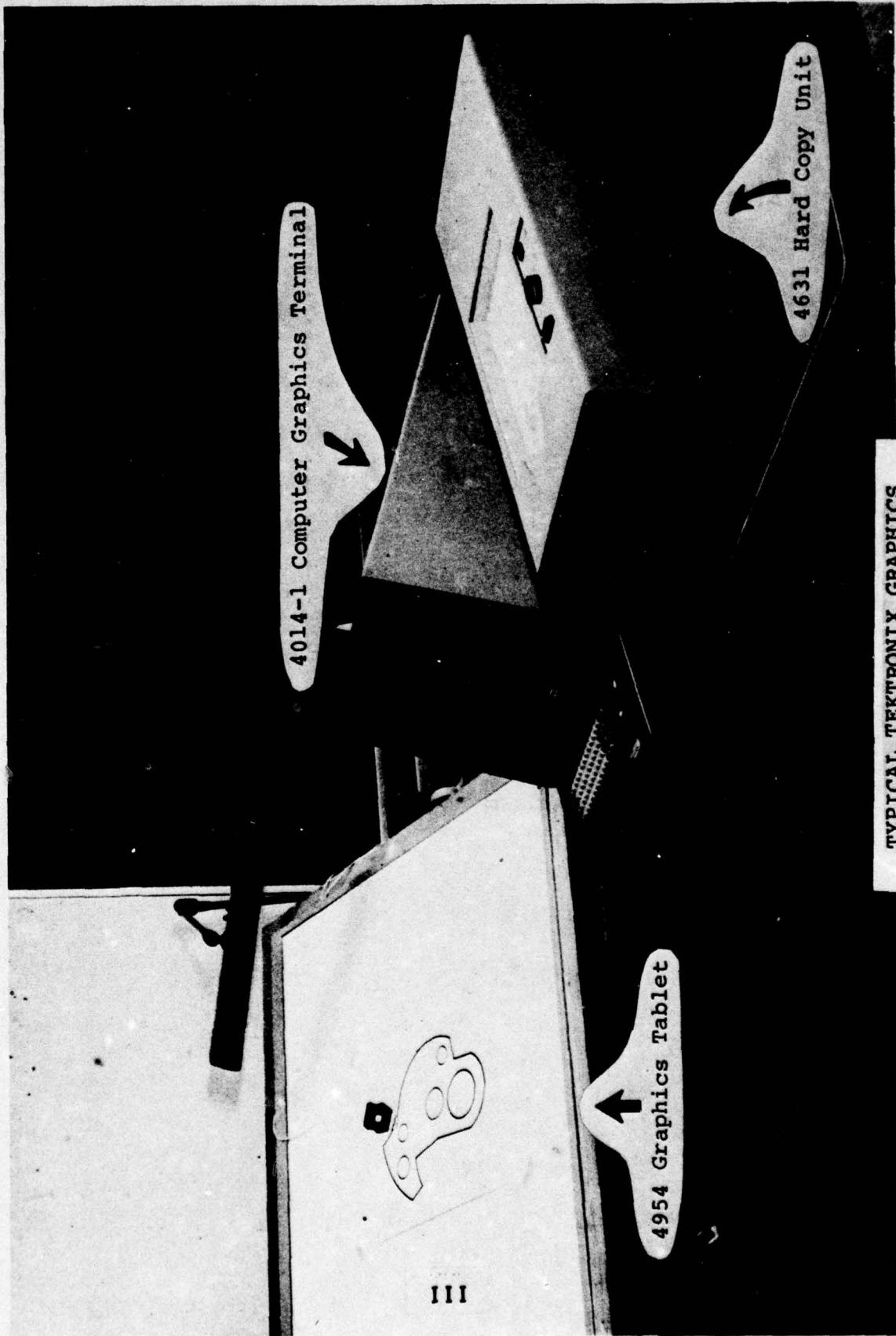


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## I. INITIALIZATION

### DATA SET PREPARATION

There are two ways that data sets may be read by GRAF-TEK. One way allows the user to type in the data via the Tektronix keyboard. To do this, simply initiate GRAF-TEK (follow instructions on RUNNING GRAF-TEK which follows this section) and when it recognizes that no data has been previously supplied it will set up the Tektronix terminal for data type in. Since this data preparation occurs during program execution, it will be described in detail later in the manual.

The other way has the user prepare data on punch cards prior to running GRAF-TEK. There are four types of data cards necessary for a complete data set. They are a title card, a number of points card, a real-type variable format card, and the (X,Y) data. The title card allows up to 70 consecutive alphanumeric characters (7A10) suitable to describe the data set. The number of points card indicates the number of (X,Y) pairs in the data set and is also identical to the number of cards necessary in card type four. This should be an integer, right justified (I3) ending in column 3, and at most 100. The variable format card contains a user determined format for the real-type data. A typical card might be (2F10.3). The last card type is the complete data set made up of two or more consecutive cards each prepared according to the variable

format card. These are the (X,Y) data points with each card having one (X,Y) pair. The number of cards needed then is the same as supplied on the number of points card. Any ordering of the data points is allowed. A typical data set is on the opposite page.

For GRAF-TEK to read these cards they must be pre-stored as a disk file on the CDC 6500/6600 computer. A separate job must be run prior to executing GRAF-TEK. The necessary control cards follow.....

```
GRAFTEK.  
COMMENT. (XXX-YYY,NNNNL), user name  
REQUEST,DATA,*PF.  
COPYCF,INPUT,DATA.  
CATALOG,DATA,GRAFTEKDATA, ID= user name.  
7-8-9 card
```

Data sets

6-7-8-9 card

When this has been successfully achieved, you're ready to run GRAF-TEK.

10

PORTMAN Coding Form

6X28-7327-6 U/M 050  
Printed in U.S.A.

PROGRAM		DATE		PUNCHING INSTRUCTIONS	GRAPHIC PUNCH	PAGE OF CARD ELECTRO-NETWORK	
PROGRAMMER							

\*A standard card form, IBM electro 888157, is available for punched statements from this form.

RUNNING GRAF-TEK

After activating a Tektronix terminal and LOGIN has been successful, type the following control cards at the console...

```
ETL,100.  
FETCH,GRAFTEK,MISDSEAD.  
ATTACH,DATA,GRAFTEKDATA,ID= user name. *  
REQUEST,PLOT,*PF. **  
GRAFTEK.
```

NOTE: Supply this card only if data has been pre-stored on the  
\* CDC 6500/6600 computer system. The local file name DATA  
is required when attaching GRAF-TEK data.

Supply this card if data will be saved via HARD COPY for  
\*\* generating CALCOMP Plots. Please review the discussion  
about this later in the manual.

G R A F - T E K

CURVE FITTING ALGORITHM FOR A TEKTRONIX 4014  
GRAPHICS DISPLAY TERMINAL

DEVELOPED AT U.S. ARMY PICATINNY ARSENAL  
DOVER, N.J.

MANAGEMENT INFORMATION SYSTEMS DIRECTORATE  
SCIENTIFIC AND ENGINEERING APPLICATIONS DIVISION

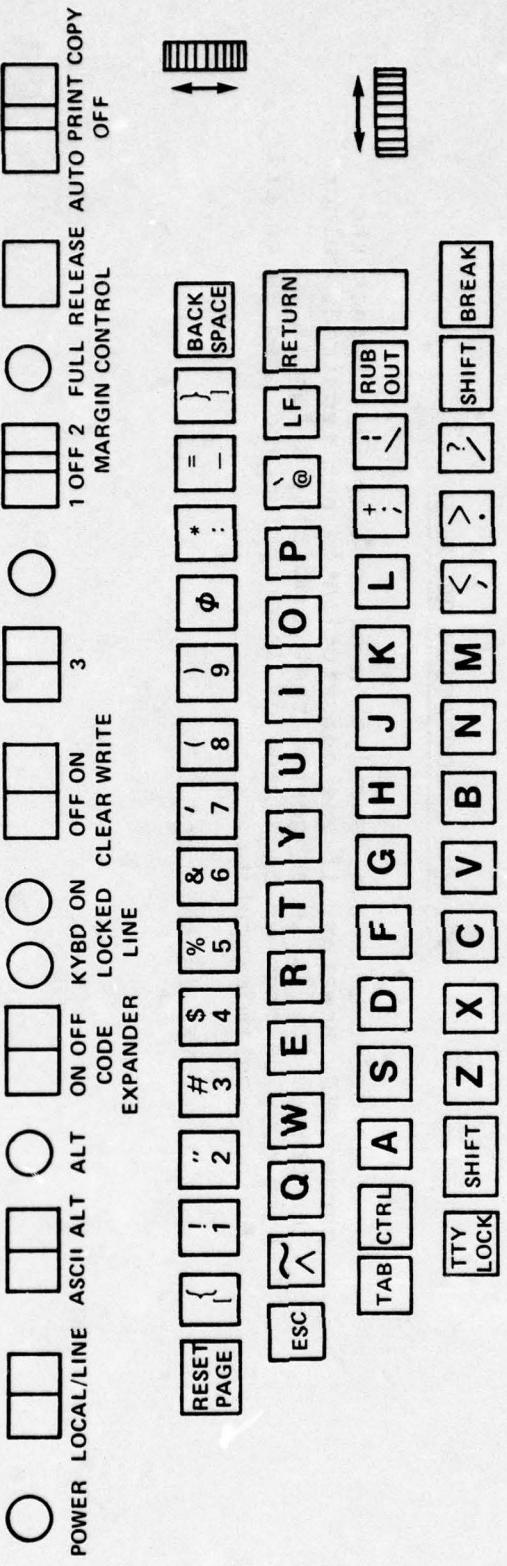
DEVELOPED BY

R.E. BARNAS / U.D. LUNGER

MARCH 1976

VERSION 1

In order to logically flow through GRAF-TEK, commands must be made. To indicate this to the program the graphic cross-hairs are employed. Moving the cross-hairs is achieved by rotating the thumb wheels located on the right side of the console keyboard board (see opposite page for a close-up view of the Tektronix keyboard). The intersection of the cross-hairs indicate the desired screen location. Place the cross-hairs over the intended option or curve mnemonic and then depress any keyboard key (except the return key). The performance of this task will be notated as "select the phrase" within the text of this manual.



OPTIONS DESCRIPTION REQUEST

In order to see a description of each option, select the phrase YES. However, if the description is not required, select the phrase NO. It is suggested that initially a "quick look" hard copy be made of each page of description and used as an aid during program execution.

Here, YES is selected.

DO YOU WANT TO SEE A DESCRIPTION OF THE OPTIONS. PICK

YES

NO

Immediately the screen erases and the first page of option description appears. To read the next page, select the phrase NEXT PAGE or at any time end the description set by selecting the phrase FINISHED.

NEW PAGE

FINISHED

READ IN NEW DATA (READ)

CAUSES THE CURRENT SCREEN CONTENTS TO ERASE AND THE NEXT DATA SET TO BE READ. SUBSEQUENTLY, THE NEW DATA POINTS WILL APPEAR SCALED TO FIT NICELY WITHIN THE PROGRAM SUPPLIED AXES.

IF THE DATA SETS HAVE BEEN EXHAUSTED, THERE ARE THREE CHOICES,

- 1- TYPE IN A NEW DATA SET VIA THE ALPHANUMERIC KEYBOARD, OR
- 2- REREAD THE OLD DATA SET, OR
- 3- END GRAF-TEK.

RESCALE AXES (RESC)

SELECTS A SCALE SUCH THAT ALL THE DATA POINTS WILL FIT NICELY WITHIN THE PROGRAM SUPPLIED AXES. THE SCREEN WILL CLEAR AND THE NEW RESCALED AXES WILL APPEAR.

S-L FORM (S-L)

CHANGES THE SCREEN PHRASES TO A SHORT, MORE CRYPTIC DISPLAY. THIS SHORTENS DISPLAY REGENERATION TIME AND TAKES EFFECT THE NEXT TIME THE SCREEN IS ERASED. SELECT AGAIN TO RETURN TO THE LONG FORM. IT IS SUGGESTED THAT A COPY BE MADE OF THE LONG FORM DISPLAY AND USED AS A REFERENCE WHEN THE SHORT FORM OPTION IS IN EFFECT.

DELETE ALL CURVES (D CU)

CLEAR THE SCREEN AND RETURNS A DISPLAY THAT REFLECTS THE CURRENT DATA SET STATUS WITH ALL CURVES ELIMINATED.

Again, the phrase NEXT PAGE is selected.

NEW PAGE

CONTINUED

DELETE POINT(S) (D PT)

ENABLES THE DELETION OF A POINT OR COMBINATION OF POINTS FROM THE DATA SET SO THAT MODIFIED CURVE FITTINGS MAY BE OBTAINED - PERHAPS GIVING A BETTER FIT. IN ORDER TO DELETE A POINT, LOCATE THE CROSS-HAIRS OVER THE DESIRED POINT REPRESENTED BY AN X OR \* AND TYPE ANY ARBITRARY CHARACTER. AN O WILL APPEAR OVER THE X OR \* INDICATING THAT FUTURE CALCULATIONS ON THE CURRENT DATA SET WILL NOT INCLUDE THE DELETED POINT(S).

ADD NEW POINT(S) (ADD)

ALLOWS THE ADDITION OF NEW DATA POINTS TO THE CURRENT DATA SET VIA THE ALPHANUMERIC KEYBOARD. THE DATA IS ENTERED IN PAIRS OF X AND Y COORDINATES WITH EACH ELEMENT FOLLOWED BY A COMMA. THE DATA IS ENTERED IN FREE FORMAT, WITH OR WITHOUT A DECIMAL POINT, OR CAN BE ENTERED IN E FORMAT NOTATION. MORE THAN ONE LINE OF DATA CAN BE ENTERED. THE ADDED DATA POINTS WILL APPEAR AS AN X.

ORIGINAL POINTS (ORIG)

CLEAR THE SCREEN AND REDISPLAYS THE ORIGINAL SET OF DATA POINTS.

NEW PTS., NEW ORG (NEW)

CLEAR THE SCREEN AND CLEANS UP THE CURRENT DATA SET. ALL DELETED POINTS ARE PERMANENTLY ELIMINATED AND ALL ADDED POINTS ARE PERMANENTLY RETAINED. NEW SELECTING 'ORIGINAL POINTS' WILL RETURN THIS CLEARED UP DATA SET.

NEXT PAGE

FINISHED

DISPLAY A CURVE (DISP)

ALLOWS FOR THE SELECTION OF ANY OF THE NINE EMPIRICAL OR ELEVEN HTM DEGREE POLYNOMIAL EQUATIONS AT THE LEFT OF THE GRAPH AREA. A MAXIMUM OF THREE CURVES MAY BE DISPLAYED AT ONE TIME. TO DISPLAY ADDITIONAL CURVES THE PHRASE 'DELETE ALL CURVES' MUST FIRST BE CHOSEN. ONCE 'DISPLAY A CURVE' HAS BEEN SELECTED, EACH OF THE THREE CURVES MAY BE PICKED CONSECUTIVELY WITHOUT RE-SELECTING 'DISPLAY A CURVE'.

RESTORE DELETED POINTS (REST)

ALLOWS ANY PREVIOUSLY DELETED POINT TO BE RESTORED AND INCLUDED AGAIN IN THE CURRENT DATA SET. PLACE THE CROSS-MAIRS OVER THE DESIRED POINT AND TYPE ANY ARBITRARY CHARACTER. THE O OF THE DELETED POINT WILL BE WRITTEN OVER WITH A S.

REVERSE X AND Y (REV)

CLEAR'S THE SCREEN AND REDISPLAYS THE DATA SET WITH THE X VALUES AND Y VALUES INTERCHANGED.

HARD COPY (HARD)

STORES ALL NECESSARY INFORMATION ABOUT THE LAST DISPLAYED CURVE ON TO A DISK STORAGE FILE WITH LOCAL FILE NAME PLOT. CATALOGING PLOT AT THE CONCLUSION OF GRAF-TEK WILL SAVE THE FILE SO THAT A CAL-CORP DRAW PLOT CAN BE PREPARED AT A LATER TIME BY RUNNING THE GRAF-TEK PLOT PROGRAM.

NEXT PAGE

FINISHED

SPECIFY CONSTANTS (SPEC)

ALLOWS EXPERIMENTATION ON ANY EMPIRICAL EQUATION SELECTED TO FIT THE DATA. A CURVE IS SELECTED IN THE NORMAL FASHION AND ITS RESULTS DISPLAYED. THEN ANY OF THE CALCULATED CONSTANTS CAN BE MODIFIED TO SEE THEIR AFFECT. SELECTING THE PHRASE "DISPLAY" WILL CAUSE THE MODIFIED EQUATION TO BE PLOTTED AND ITS RESULTS TO APPEAR. TO CHANGE MORE THAN ONE CONSTANT, SELECT THE PHRASE "ENTER". ONLY ONE EMPIRICAL EQUATION CAN BE WORKED ON AT A TIME. THERE ARE ONLY TWO PHRASES THAT CAN BE SELECTED TO GET OUT OF THIS OPTION, AND THEY ARE "DONE" AND "END OF PROGRAM" (END).

CHANGE TITLE (CHAN)

ALLOWS THE CURRENT TITLE TO BE CHANGED TO A NEW TITLE. UP TO 70 CHARACTERS ARE ALLOWED AND IT WILL REAPPEAR IN ITS NORMAL POSITION THE NEXT TIME THE SCREEN CLEARS.

PUNCH DECK (PUNC)

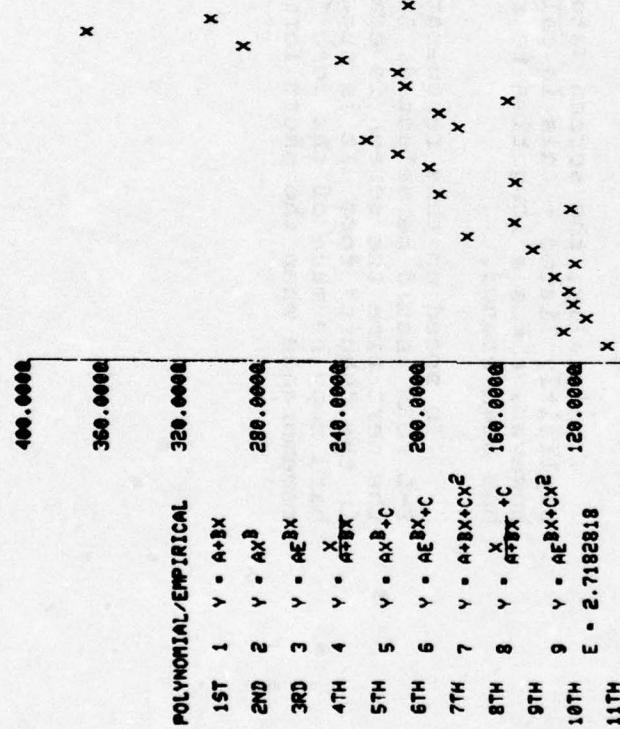
GIVES PUNCH DECK OUTPUT WHICH CONTAINS ANY ADDED AND ALL NON-DELETED POINTS REPRESENTING THE CURRENT DATA SET.

END OF PROGRAM (END)

TERMINATES GRAF-TEK AND CLEARS THE SCREEN.

If the phrase FINISHED had been selected or description set exhausted, the following display appears. On the left of the display is the set of 11 polynomials and 9 empirical equations; in the center is the point and curve viewing axis; on the right is the option list; and, on the bottom is an area for results and additional procedure requests.

## PICATINNY

NO. OF POINTS = 26  
BEST FIT =

80.0000 120.0000 160.0000 200.0000 240.0000 280.0000 320.0000 360.0000 400.0000 440.0000 480.0000 520.0000 560.0000 600.0000 640.0000 680.0000

PUNCH DECK

END OF PROGRAM

## OPTIONS

- READ IN NEW DATA
- RESCALE AXES
- S-L FORM
- DELETE ALL CURVES
- DELETE POINT(S)
- ADD NEW POINT(S)
- ORIGINAL POINTS
- NEW PTS. NOT ORG.
- DISPLAY A CURVE
- RESTORE DELETED POINT(S)
- REVERSE X AND Y
- SPECIFY CONSTANTS
- HARD COPY
- CHANGE TITLE

## CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

S-L FORM

Initially, the screen setup has the options and curves explicitly listed - this is called the "long" form. This, however, takes a long time to regenerate after the screen has been erased.

To speed up this regeneration, the option phrase **S-L FORM** should be selected. An internal flag is set, and the next time the screen is erased the display will regenerate in the "short" form. It is suggested that a "quick look" hard copy be made of the long form display and used as a remembrance when the short form option is in effect.

## PICATTINNY

400.0000

360.0000

## POLYNOMIAL/EMPIRICAL

		1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	11TH
Y = A + BX	X	X										
Y = AX <sup>2</sup>		X										
Y = AX <sup>3</sup>			X									
Y = AX <sup>4</sup>				X								
Y = AX <sup>5</sup> + C					X							
Y = AX <sup>6</sup> + C						X						
Y = AX <sup>7</sup> + CX <sup>2</sup>							X					
Y = AX <sup>8</sup> + CX <sup>2</sup>								X				
Y = AX <sup>9</sup> + CX <sup>2</sup>									X			
E = 2.7182818										X		

30.0000  
32.0000  
34.0000  
36.0000  
38.0000  
40.0000  
42.0000  
44.0000  
46.0000  
48.0000  
50.0000  
52.0000  
54.0000  
56.0000  
58.0000  
60.0000  
62.0000  
64.0.0000  
67.0.0000

## END OF PROGRAM

NO. OF POINTS = 26  
BEST FIT =

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE -  
COEFFICIENT OF  
DETERMINATION.

III. DISPLAYING A CURVE

DISPLAY A CURVE

To begin searching for the best curve fitting the data set, select the phrase DISPLAY A CURVE.

## PICATINNY

		POLYNOMIAL/EMPIRICAL	320.0000
1ST	1	$y = A + BX$	x
2ND	2	$y = Ax^2$	x
3RD	3	$y = AxBx$	220.0000
4TH	4	$y = AxBx^2$	240.0000
5TH	5	$y = Ax^3 + C$	x
6TH	6	$y = Ax^3 + Cx$	200.0000
7TH	7	$y = AxBx + Cx^2$	x
8TH	8	$y = AxBx + C$	160.0000
9TH	9	$y = AxBx + Cx^2$	x
10TH	E	$E = 2.7182818$	120.0000
11TH			x

## OPTIONS

READ IN NEW DATA  
 RESCALE AXES  
 S-L FORM  
 DELETE ALL CURVES  
 DELETE POINT(S)  
 ADD NEW POINT(S)  
 ORIGINAL POINTS  
 NEW PTS. NEW ORGS.  
 DISPLAY A CURVE  
 RESTORE DELETED POINT(S)  
 REVERSE X AND Y  
 SPECIFY CONSTANTS  
 HARD COPY  
 CHANGE TITLE  
 PUNCH DECK  
 END OF PROGRAM

30.0000  
 160.0000 240.0000 320.0000 400.0000 560.0000 640.0000  
 640.0000

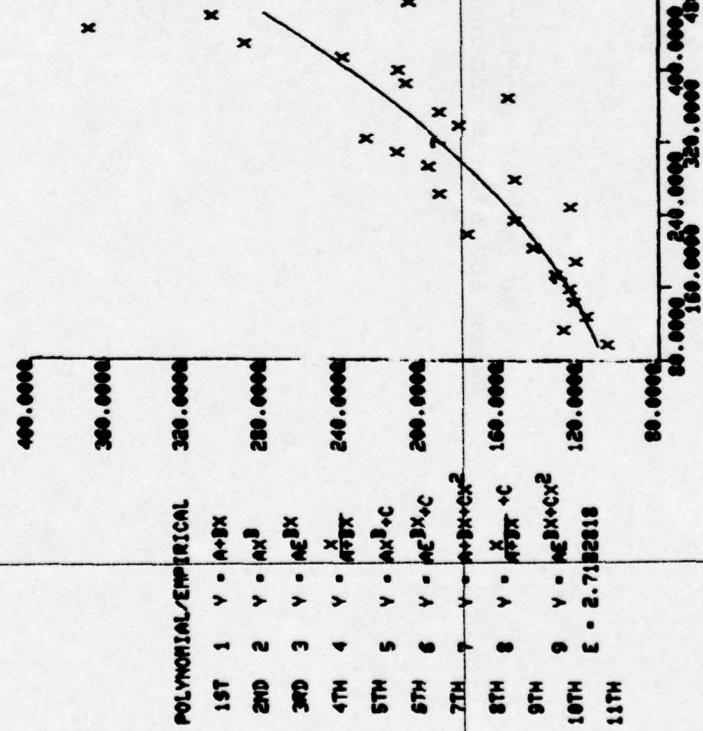
NO. OF POINTS = 26  
BEST FIT =

## CURVE

A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE  
 COEFFICIENT OF  
 DETERMINATION

Then when the cross-hairs have redisplayed, the desired polynomial or empirical equation for fitting the data may be selected. After the arbitrary keyboard character is depressed, a curve is calculated, drawn through the data points, and labelled with its associative identification number. Additionally, the curves' statistical results are listed below.

## PICATINNY



NO. OF POINTS = 26  
BEST FIT = 7



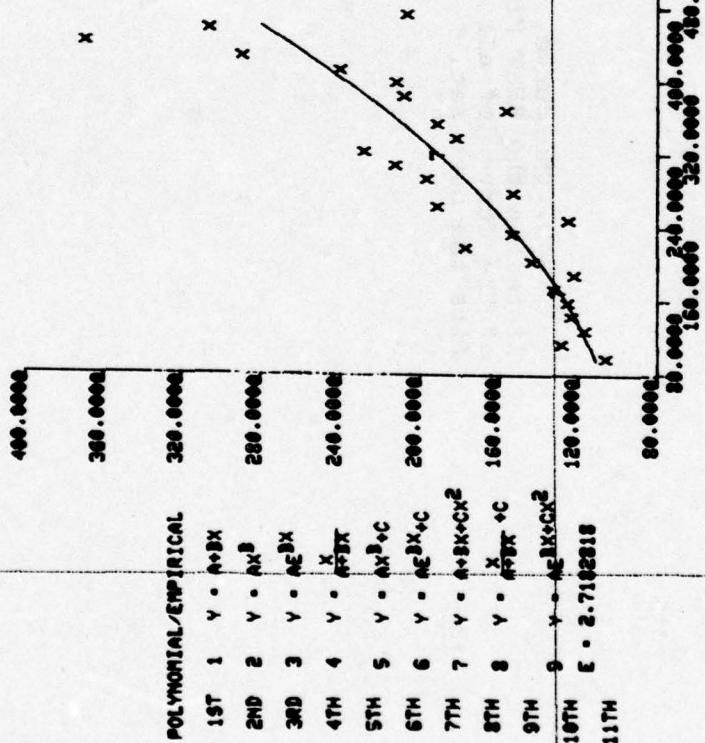
23

CURVE 7  
 A = 101.4954  
 B = .6446  
 C = .0007  
 STAND. ERROR  
 OF ESTIMATE = 34.1910  
 COEFFICIENT OF  
 DETERMINATION = .7982

OPTIONS  
 READ IN NEW DATA  
 RESCALE AXES  
 S-L FORM  
 DELETE ALL CURVES  
 DELETE POINT(S)  
 ADD NEW POINT(S)  
 ORIGINAL POINTS  
 NEW PTS. NEW ORG.  
 DISPLAY A CURVE  
 RESTORE DELETED POINT(S)  
 REVERSE X AND Y  
 SPECIFY CONSTANTS  
 HARD COPY  
 CHANGE TITLE  
 PUNCH DECK  
 END OF PROGRAM

To look at another curve, just re-position the cross-hairs and select another curve.

## PICATTINNY



## OPTIONS

READ IN NEW DATA

RESCALE AXES

S-L FORM

DELETE ALL CURVES

DELETE POINT(S)

ADD NEW POINT(S)

ORIGINAL POINTS

NEW PTS. NOU ORG.

DISPLAY A CURVE

RESTORE DELETED POINT(S)

REVERSE X AND Y

SPECIFY CONSTANTS

HARD COPY

CHANGE TITLE

PUNCH DECK

END OF PROGRAM

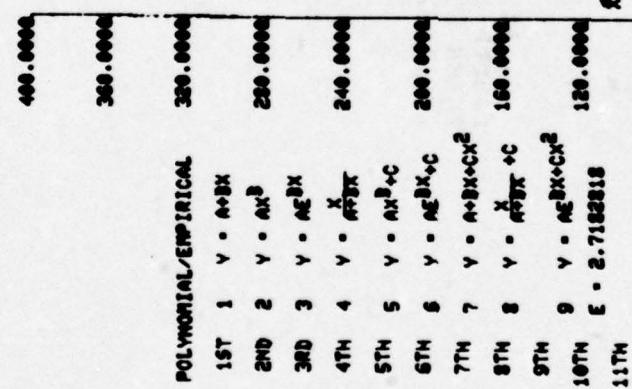
CURVE 7  
 A = 101.4954  
 B = .0049  
 C = .0007  
 STAND. ERROR  
 OF ESTIMATE = 34.1910  
 COEFFICIENT OF  
 DETERMINATION = .7628

NO. OF POINTS • 26  
BEST FIT • 7

80.0000  
 100.0000  
 120.0000  
 140.0000  
 160.0000  
 180.0000  
 200.0000  
 220.0000  
 240.0000  
 260.0000  
 280.0000  
 300.0000  
 320.0000  
 340.0000  
 360.0000  
 380.0000  
 400.0000

Now, the curve, its label, and its results display. Listed in the BEST FIT area is the identification number of the curve (of all curves selected thus far) that best fits the data set.

## PICATINNY



NO. OF POINTS = 25  
BEST FIT = 7

27

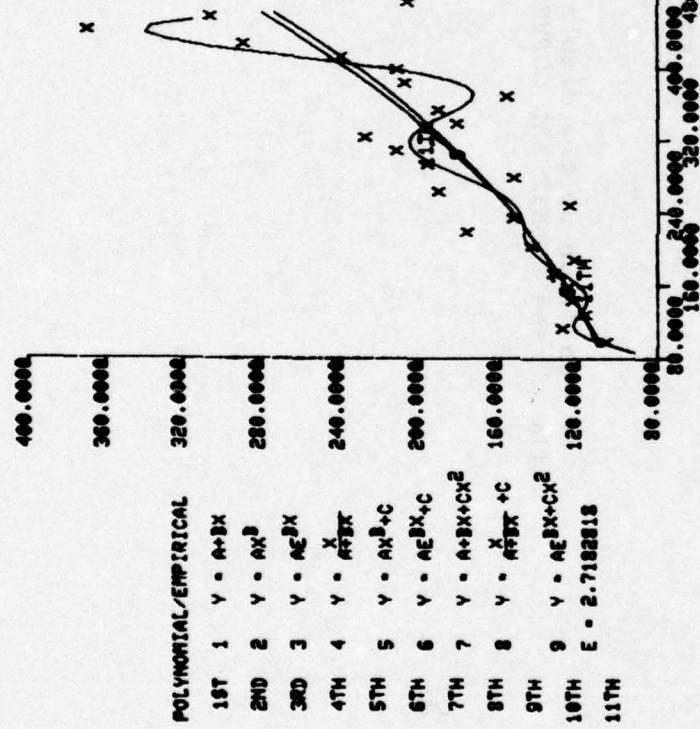
OPTIONS  
READ IN NEW DATA  
RESCALE AXES  
S-L FORM  
DELETE ALL CURVES  
DELETE POINT(S)  
AND NEW POINT(S)  
ORIGINAL POINTS  
NEW PTS. NEW ORG.  
DISPLAY A CURVE  
RESTORE DELETED POINT(S)  
REVERSE X AND Y  
SPECIFY CONSTANTS  
HARD COPY  
CHANGE TITLE  
PUNCH DECK  
END OF PROGRAM

CURVE 7  
A = 101.4954  
B = .0440  
C = .0007  
STAND. ERROR  
OF ESTIMATE = 34.1910  
COEFFICIENT OF  
DETERMINATION = .7682

CURVE 9  
A = 2381  
B = .0021  
C = .0000  
STAND. ERROR  
OF ESTIMATE = 34.3750

At most 3 curves may be displayed at one time. If a fourth is attempted, an informative diagnostic MAXIMUM OF THREE CURVES ONLY appears. No more curves can be displayed until all the curves have been eliminated.

## PICATINNY



NO. OF POINTS = 26  
BEST FIT - 7

CURVE 7  
 A = 101.4954  
 B = .0449  
 C = .0007  
 STAND. ERROR  
 OF ESTIMATE= 34.1910  
 COEFFICIENT OF  
 DETERMINATION= .7962

CURVE 9  
 A = 22381  
 B = .0021  
 C = .0006  
 STAND. ERROR  
 OF ESTIMATE= 34.3750  
 COEFFICIENT OF  
 DETERMINATION= .6482

MAXIMUM OF THREE CURVES ONLY

OPTIONS  
 READ IN NEW DATA  
 RESCALE AXES  
 S-L FORM  
 DELETE ALL CURVES  
 DELETE POINT(S)  
 ADD NEW POINT(S)  
 ORIGINAL POINTS  
 NEW PTS. NOV ORG.  
 DISPLAY A CURVE  
 RESTORE DELETED POINT(S)  
 REVERSE X AND Y  
 SPECIFY CONSTANTS  
 HARD COPY  
 CHANGE TITLE  
 PUNCH DECK  
 END OF PROGRAM

DELETE ALL CURVES

To clean up the display area and start anew, select  
the phrase DELETE ALL CURVES.

## PIGATINV

400.0000

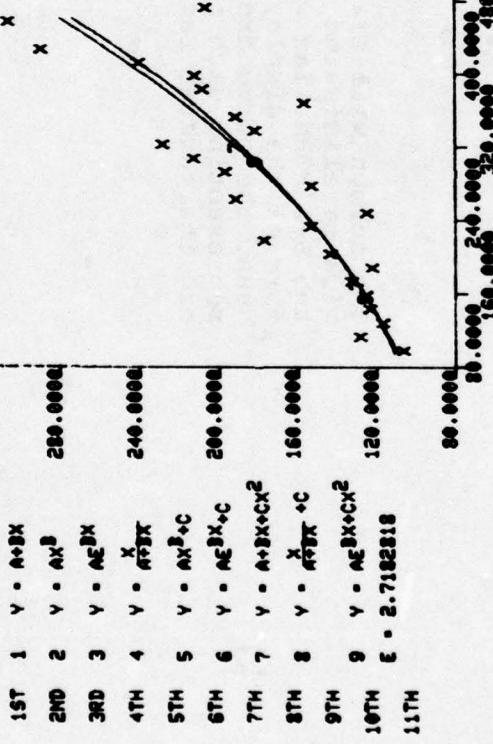
380.0000

360.0000

340.0000

## POLYNOMIAL/EMPIRICAL

320.0000

NO. OF POINTS = 26  
BEST FIT = ?

20.0000 30.0000 40.0000 50.0000 60.0000 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000 130.0000 140.0000 150.0000 160.0000 170.0000 180.0000 190.0000 200.0000 210.0000 220.0000 230.0000 240.0000 250.0000

PUNCH DECK  
END OF PROGRAM

## OPTIONS

- READ IN NEW DATA
- RESCALE AXES
- S-L FORM
- DELETE ALL CURVES
- DELETE POINT(S)
- ADD NEW POINT(S)
- ORIGINAL POINTS
- NEW PTS. NEW ORG.
- DISPLAY A CURVE
- RESTORE DELETED POINT(S)
- REVERSE X AND Y
- SPECIFY CONSTANTS
- HARD COPY
- CHANGE TITLE

CURVE 7  
 A = 101.4954      9  
 B = .9446      89.2391  
 C = .0007      .0021  
 .0000  
 STAND. ERROR      .0007  
 OF ESTIMATE = 34.1910  
 COEFFICIENT OF  
 DETERMINATION = .7062      .6482

The screen will erase and the curves and their results will be eliminated from the new display. At this time the S-I FORM flag will be recognized and the short form of the display screen will appear. As can be seen, the curve area has been reduced to numbers representing each curve, and the option area has had its phrases reduced to short catchy reminders.

## PICATINNY

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEW

DISP

REST

REUE

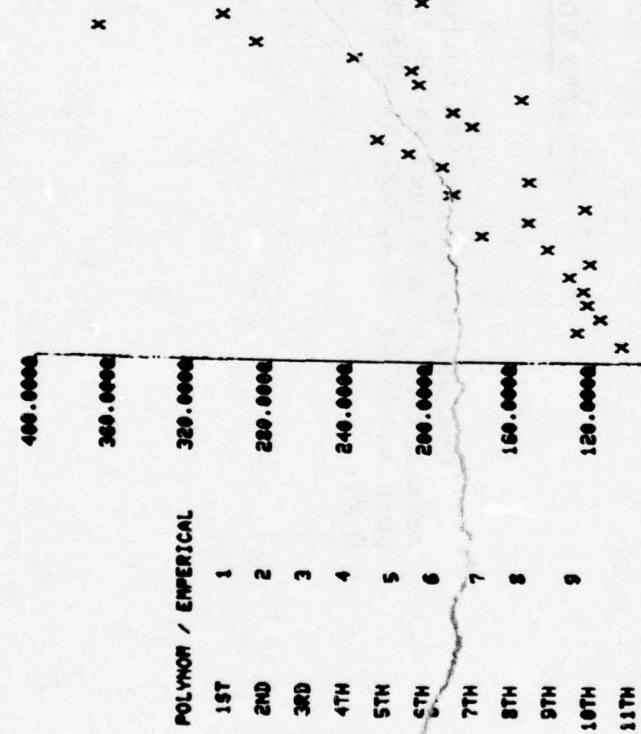
SPEC

HARD

CHAN

PUNC

END

NO. OF POINTS - 26  
BEST FIT -

20.0000 30.0000 40.0000 50.0000 60.0000 70.0000 80.0000 90.0000 100.0000 110.0000 120.0000 130.0000 140.0000 150.0000 160.0000 170.0000 180.0000 190.0000 200.0000 210.0000 220.0000 230.0000 240.0000 250.0000 260.0000 270.0000 280.0000 290.0000 300.0000 310.0000 320.0000 330.0000 340.0000 350.0000 360.0000 370.0000 380.0000 390.0000 400.0000

CURVE  
 A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE -  
 COEFFICIENT OF  
 DETERMINATION -

### III. MODIFYING THE DATA SET

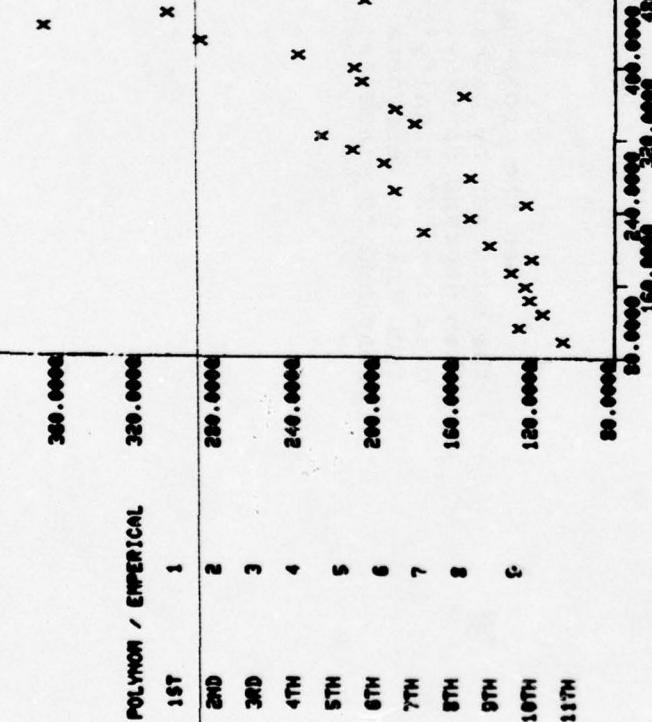
#### DELETE POINT(S)

One way to modify the current data set is to delete points from it and then fit a curve through the remaining points. To do this, select the phrase DELETE POINT(S) or D PT.

## PICKATINNY

## OPTIONS

READ    RESC    S-L    D CU    D PT



NO. OF POINTS = 26  
BEST FIT =

20.000 160.000 240.000 320.000 400.000 480.000 560.000 640.000 720.000

## CURVE

A =

B =

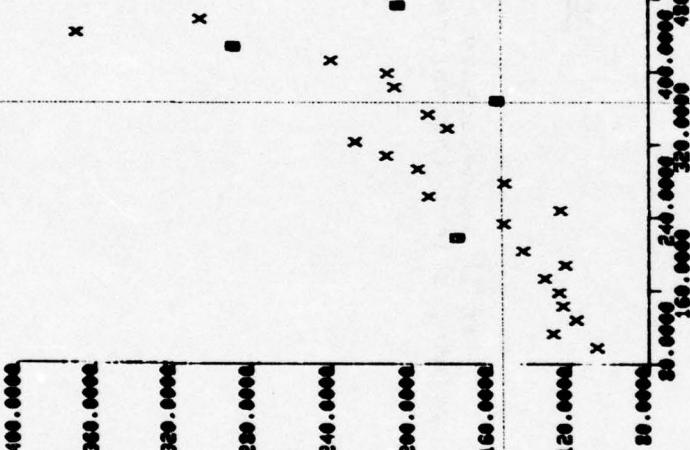
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

When the cross-hairs reappear, remove a point from the data set by placing the cross-hairs over its "X" and then depress any key. Immediately an "O" will appear over the "X" signifying that this point has been excluded from the current data set. To eliminate some more, continue to place the cross-hairs over the desired points.

## PICATINNY

## OPTIONS

READ  
RESC  
S-L  
D CV  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
RCLE



NO. OF POINTS - 26  
BEST FIT -

## CURVE

A -  
B -  
C -  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

RESTORE POINTS

If it is necessary to bring back previously deleted points, select the phrase RESTORE POINTS or REST.

PICATTINNY

OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEU

DISP

REST

RELU

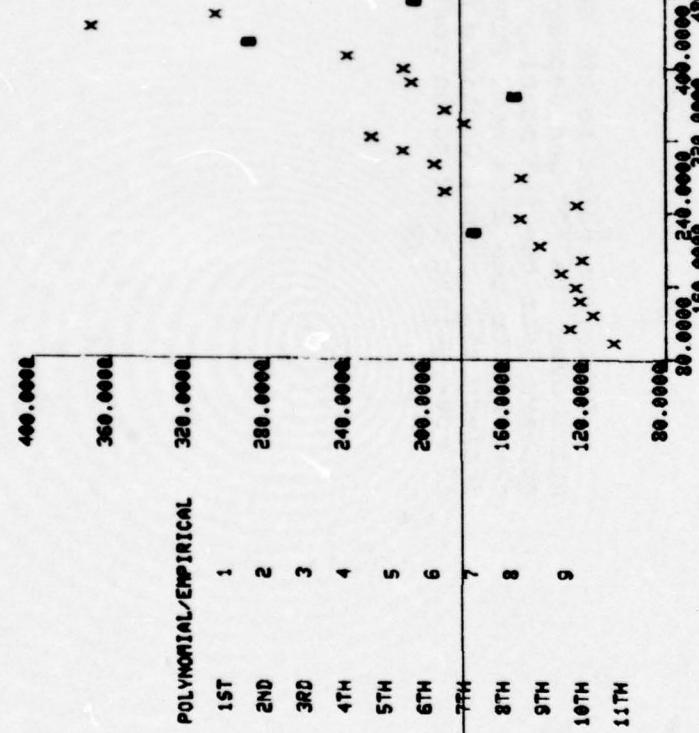
SPEC

HARD

CHAN

PLNC

END



Restore a point to the data set by placing the cross-hairs over its "O" and depress any key. Immediately a "\$" appears over the "O" meaning that this point has been returned to the data set. Future calculations will now include this point. Continue to re-position the cross-hairs if more points need to be restored.

PICATINNY

OPTIONS

READ  
RESC  
S-L  
D CV  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST

400.0000

360.0000

320.0000

POLYNOMIAL/EMPIRICAL

1ST	1	x
2ND	2	■
3RD	3	
4TH	4	x
5TH	5	x
6TH	6	x x x
7TH	7	x x x
8TH	8	x x
9TH	9	x x x x
10TH	10	x x x x
11TH	11	x

240.0000  
200.0000  
160.0000  
80.0000  
340.0000  
320.0000  
400.0000  
120.0000  
560.0000  
520.0000  
160.0000  
720.0000

END

NO. OF POINTS = 26 22  
BEST FIT .

CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

ADD NEW POINT(S)

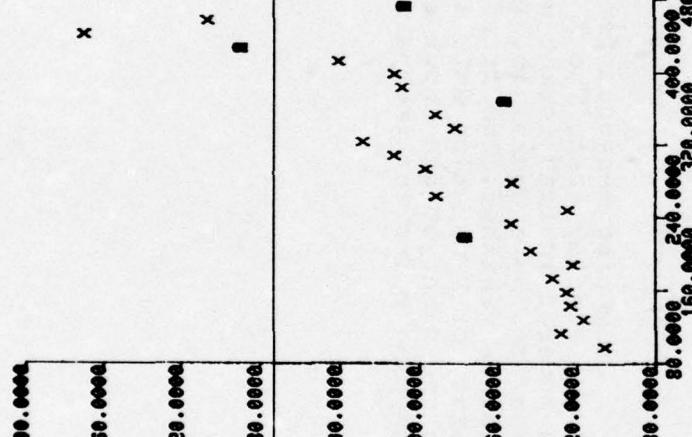
Another way to modify the current data set is to add points. To do this, select the phrase ADD NEW POINT(S) or ADD.

## PICATIONNY

## OPTIONS

READ REC S-L D CU D PT ADD

ORIG NEU DISP REST RUE SPEC HARD CHAN FUNC END



NO. OF POINTS = 22  
BEST FIT -

## CURVE

A =

B =

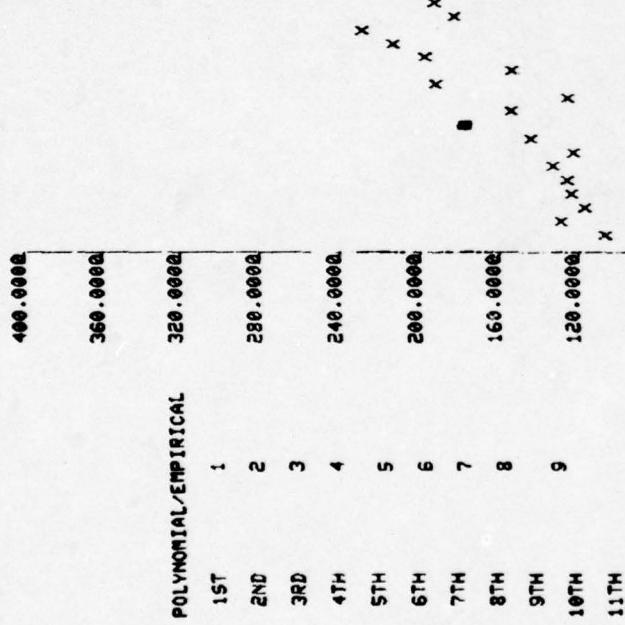
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

Prompting messages for data input appear at the bottom of the display area. The X and Y value for each data point is entered in free format with each individual X or Y separated by a comma (ie. X,Y,X,Y,...) until the desired list is finished. The free format allows integer, floating point, or E notation data inputting. The vertical slash on the right of the input area indicates the required stopping point for the particular line of input.

## PICATINNY

## OPTIONS

READ            RESC            S-L            D CU  
       D PT            ADD            ORIG            NEW  
       DISP            REST            REUE            SPEC  
       HARD            CHAN            PUNC            END



NO. OF POINTS = 26    22    24  
 BEST FIT =

## CURVE

A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE  
 COEFFICIENT OF  
 DETERMINATION

END OF LINE            END OF DATA  
 PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.

If the data is complete prior to reaching this line,  
select the phrase END OF DATA.

PICATINNY

OPTIONS

400.0000

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEU

DISP

REST

REUE

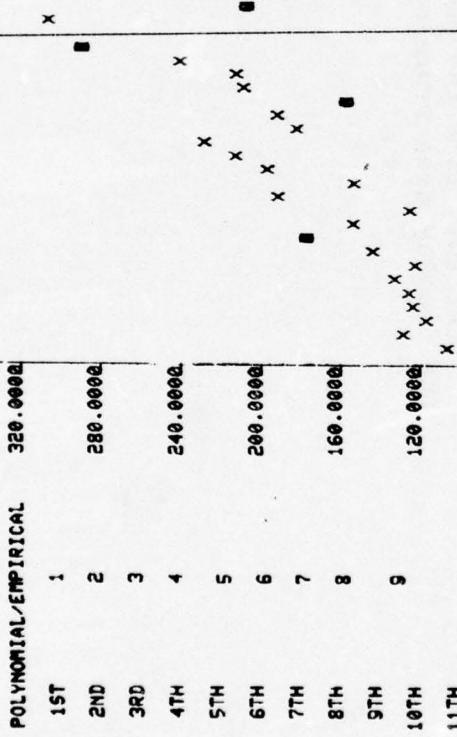
SPEC

HARD

CHAN

PUNC

END



NO. OF POINTS = 26    22    24  
BEST FIT .

CURVE

A =

B =

C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

END-OF-LINE    END-OF-DATA

PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
560,200,640,300,

At this time the new data points will display onto  
the display area represented as an \*.

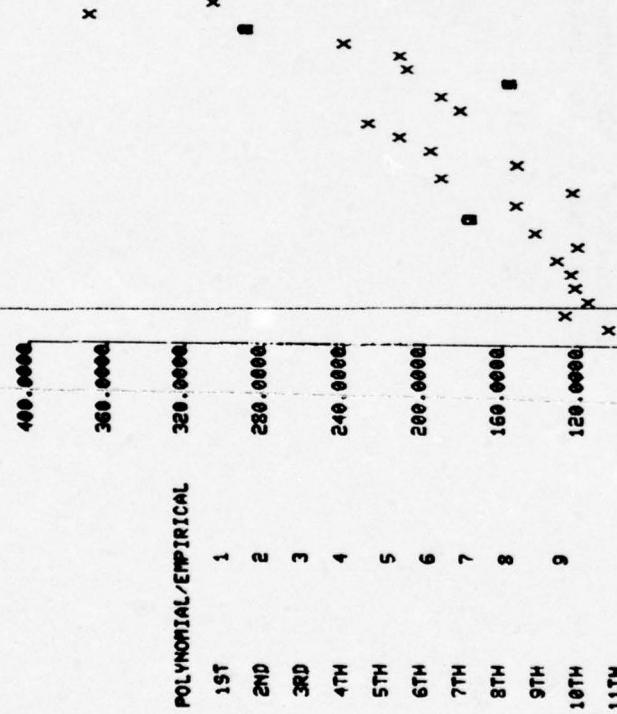


However, if the data requires more than one line to complete it, additional lines may be used. To do this, complete the current line by finishing an X,Y pair prior to the vertical slash, and then select the phrase END OF LINE.

## PICATINNY

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
REVE  
SPEC  
HARD  
CHAN  
PUNC  
END



NO. OF POINTS = 26    22    24  
BEST FIT .

CURVE  
A  
B  
C  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION=

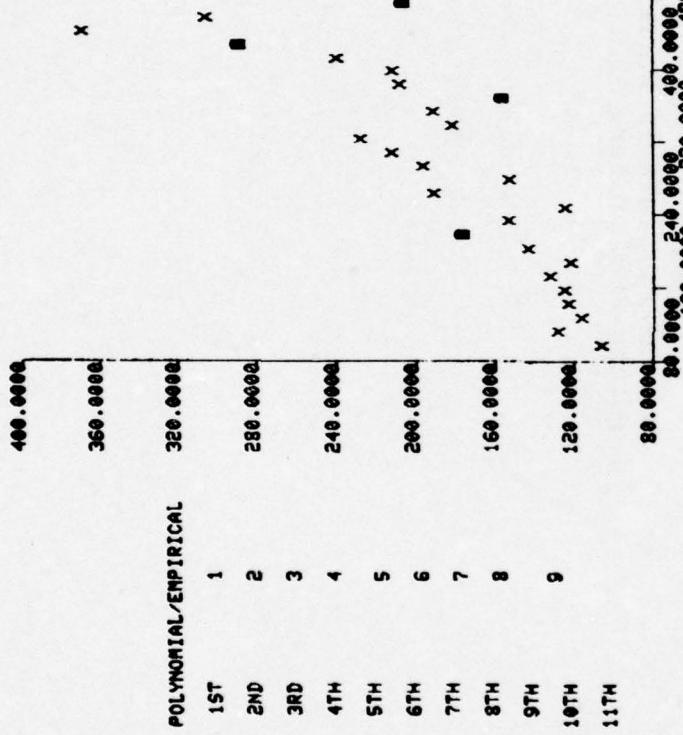
END-OF-LINE    END-OF-DATA  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
560,30,560,100,560,110,560,120,560,130,560,140,560,150,560,160,560,170,

Immediately the input cursor moves to the beginning  
of the next line ready for more data.

PICATINNY

OPTIONS

READ  
RESC  
S-L  
D-CU  
D-PT  
ADD  
ORIG  
NEW  
DISP  
REST  
RELIE  
SPEC  
HARD  
CHAN  
PUNC  
END



NO. OF POINTS = 26 22 24  
BEST FIT =

CURVE  
A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

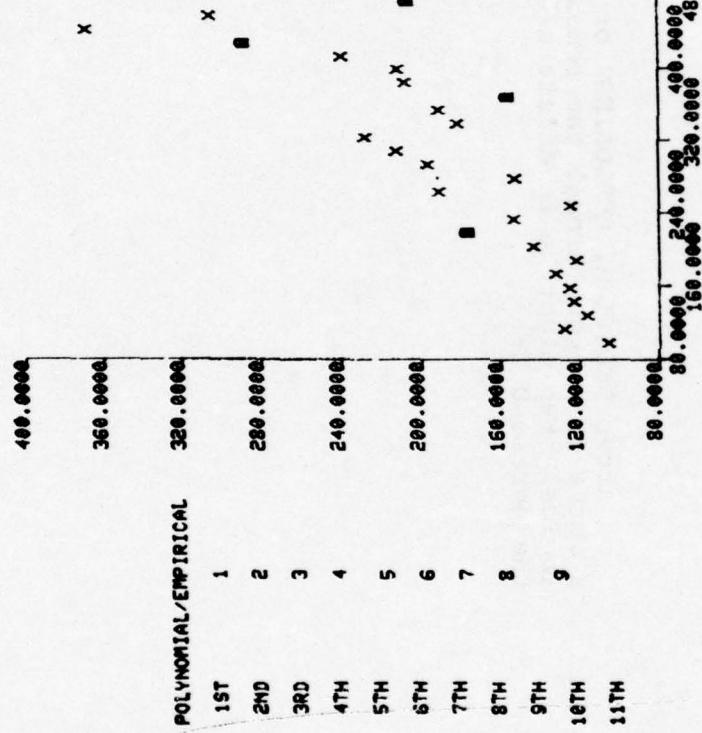
END OF LINE      END OF DATA  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
560,90,560,100,560,110,560,120,560,130,560,140,560,150,560,160,560,170,  
560,200,560,210,

When END OF DATA is finally selected the new data  
points will appear.

PICATINNY

OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEU



NO. OF POINTS = 26    22    24    35  
BEST FIT.

CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

END OF DATA  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
560,90,560,100,560,110,560,120,560,130,560,140,560,150,560,160,560,170,  
560,180,560,190,560,210,

After DELETING, RESTORING, or ADDING points and passing  
a curve or curves through the remaining data set, a next  
logical step might be to delete all the curves by selecting  
the phrase D CV:

PICATINNY

OPTIONS

READ  
RESC  
S-L

POLYNOMIAL/EMPIRICAL

1ST	1	X	X
2ND	2	280.0000	
3RD	3		
4TH	4	240.0000	
5TH	5		
6TH	6	200.0000	
7TH	7		X
8TH	8	160.0000	
9TH	9		
10TH	10	120.0000	
11TH	11		

80.0000 80.0000 240.0000 320.0000 400.0000 480.0000 560.0000 640.0000 720.0000

NO. OF POINTS = 26 22 24 26  
BEST FIT = 7

CURVE

7

A = 42.8311  
B = .5798  
C = -.0003

STAND. ERROR  
OF ESTIMATE = 37.2693  
COEFFICIENT OF  
DETERMINATION = .6588

END OF LINE END OF DATA  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
560,200,640,300,

The screen clears and the points returned. The  
DELETED points return as O's, the ADDED points as '\*'s  
and the remaining points as X's. In addition, a new  
total number of points is displayed.

## PICTINNY

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
REVE  
SPEC  
HARD  
CHAN  
PUNC  
END

	POLYNOMIAL/EMPIRICAL										
1ST	1	x									
2ND	2		0								
3RD	3										
4TH	4		x								
5TH	5		x	x	x	x	0	x			
6TH	6		x	x	x	x					
7TH	7		x	x	x	x					
8TH	8			x	x	x					
9TH	9			x	x	x					
10TH				x	x	x					
11TH				x							

400.0000  
360.0000  
320.0000  
280.0000  
240.0000  
200.0000  
160.0000  
120.0000  
80.0000  
40.0000  
0.0000

PUNC

END

NO. OF POINTS =  
BEST FIT =

26

## CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

#### IV. OTHER OPTIONS

##### ORIGINAL POINTS

At any time during the modification of the data set the original data may be seen. To restore original status select the phrase ORIGINAL POINTS or ORIG. Any modifications made to the data set prior to selecting ORIG will not be retained.

##### NEW PTS. NOW ORIG.

To consider the current data set as the original data set, select the phrase NEW PTS. NOW ORIG or NEW. Now selecting ORIG will reflect the data set current when NEW was selected.

## PICATINNY

## OPTIONS

READ  
RESC  
S-L  
DCU  
DPT  
ADD

400.0000	x
360.0000	
320.0000	x
280.0000	o
240.0000	x
200.0000	x xx
160.0000	x x x
120.0000	x xx x
80.0000	x

## POLYNOMIAL/EMPIRICAL

1ST	1	x
2ND	2	o
3RD	3	
4TH	4	x
5TH	5	x x x
6TH	6	x x x x
7TH	7	x x x x
8TH	8	x x x x
9TH	9	x x x x
10TH		x x x x
11TH		x

80.0000	240.0000	320.0000	400.0000	480.0000	560.0000	640.0000	720.0000
160.0000	240.0000	320.0000	400.0000	480.0000	560.0000	640.0000	720.0000

NO. OF POINTS = 26  
BEST FIT =

## CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE =  
COEFFICIENT OF  
DETERMINATION =

After selecting ORIG, the screen clears and the current original data set appears.

## PICATINNY

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEW

DISP

REST

REVE

SPEC

HARD

CHAN

PUNC

END

400.0000

360.0000

320.0000

## POLYNOMIAL/EMPIRICAL

1ST 1

2ND 2

3RD 3

4TH 4

5TH 5

6TH 6

7TH 7

8TH 8

9TH 9

10TH

11TH

NO. OF POINTS = 26  
BEST FIT =

63

## CURVE

A =

B =

C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.80.0000 80.0000 240.0000 400.0000 560.0000 720.0000  
160.0000 160.0000 320.0000 480.0000 640.0000

READ IN NEW DATA

If more than one data set has been prepared, the next set may be viewed by selecting the phrase READ IN NEW DATA or READ.

## PICATINNY

400.0000

360.0000

320.0000

POLYNOMIAL/EMPIRICAL

1ST 1

2ND 2

3RD 3

4TH 4

5TH 5

6TH 6

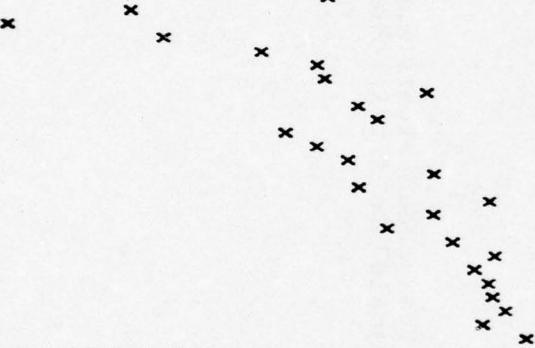
7TH 7

8TH 8

9TH 9

10TH 10

11TH 11



80.0000 110.0000 140.0000 170.0000 200.0000 230.0000 260.0000 290.0000 320.0000 350.0000 380.0000

NO. OF POINTS = 26  
BEST FIT .

## CURVE

A =

B =

C =

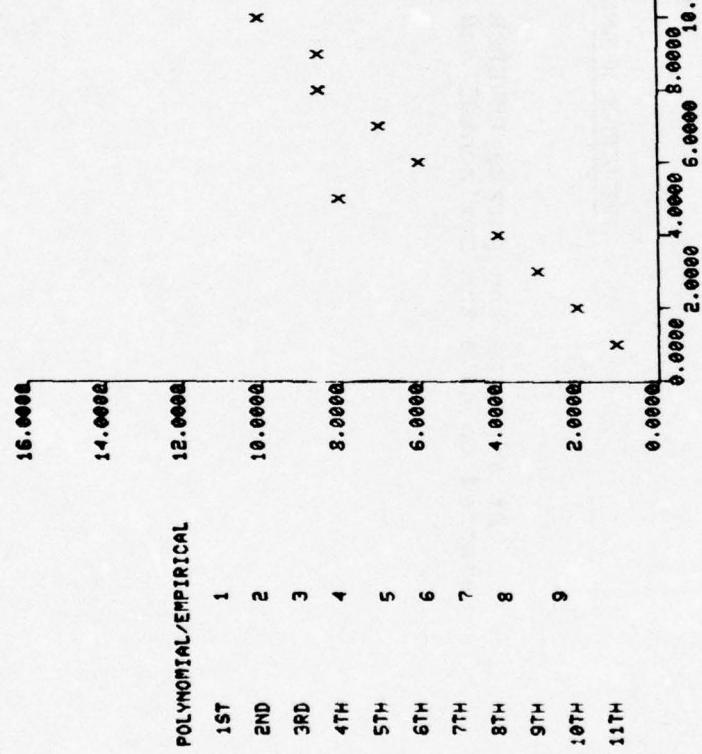
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

The screen clears and the new data appears properly scaled to fit in the viewing axis.

## TEST DATA 3

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
REUE  
SPEC  
HARD  
CHAN  
PUNC



NO. OF POINTS = 10  
BEST FIT -

## CURVE

A =

B =

C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

REVERSE X AND Y

At any time the phrase REVERSE X AND Y or REVY may be selected to have the horizontal and vertical axes switched.

## TEST DATA 3

16.0000

## OPTIONS

	READ	RESC	S-L	D CU	D PT	ADD	ORIG	NEU	DISP	REST	REUE	SPEC	HARD	CHAN	PUNC	END
POLYNOMIAL/EMPIRICAL	14.0000															
1ST	1															
2ND	2															
3RD	3															
4TH	4															
5TH	5															
6TH	6															
7TH	7															
8TH	8															
9TH	9															
10TH																
11TH																

0.0000 2.0000 4.0000 6.0000 8.0000 10.0000 12.0000 14.0000 16.0000

NO. OF POINTS = 10  
BEST FIT =

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

Again the screen clears and the reversed points appear within the viewing axis.

## TEST DATA 3

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
REUE  
SPEC  
HARD  
CHAN  
PUNC  
END

POLYNOMIAL/EMPIRICAL	16.0000	14.0000	12.0000	10.0000	8.0000	6.0000	4.0000	2.0000	0.0000
1ST	1			x					
2ND	2				x				
3RD	3				x				
4TH	4				x				
5TH	5				x				
6TH	6				x				
7TH	7				x				
8TH	8				x				
9TH	9				x				
10TH					x				
11TH					x				

0.0000 0.0000 2.0000 4.0000 6.0000 8.0000 10.0000 12.0000 14.0000 16.0000

NO. OF POINTS = 10  
BEST FIT =

## CURVE

A'

B'

C'

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

CHANGE TITLE

At any time the title of the data set may be changed.  
To begin this process, select the phrase CHANGE TITLE or  
CHAN.

## TEST DATA 3

## OPTIONS

16.0000

14.0000

12.0000

## POLYNOMIAL/EMPIRICAL

1ST	1		x
2ND	2		
3RD	3	x	
4TH	4	x	
5TH	5	x	
6TH	6	x	
7TH	7	x	
8TH	8	x	
9TH	9	x	
10TH		x	
11TH		x	

READ  
RTSC  
SIL  
DCU  
DPT  
ADD  
ORIG  
NEW  
DSP  
REST  
REFE  
SPEC  
HARD  
CHANPUNC  
END

0.0000 2.0000 4.0000 6.0000 8.0000 10.0000 12.0000 14.0000 16.0000

NO. OF POINTS = 10  
BEST FIT =

## CURVE

A =

B =

C =  
STAND. ERROR  
OF ESTIMATE  
COEFFICIENT OF  
DETERMINATION.

At once, the input cursor will appear approximately in the center of the screen. Up to 70 consecutive characters may be typed as a new title.

## TEST DATA 3

16.0000

## POLYNOMIAL/EMPIRICAL

1ST	1		x
2ND	2	10.0000	x
3RD	3		x
4TH	4	8.0000	x
5TH	5		x
6TH	6	6.0000	x
7TH	7		x
8TH	8	4.0000	x
9TH	9		x
10TH		2.0000	x
11TH		0.0000	

0.0000 2.0000 4.0000 6.0000 8.0000 10.0000 12.0000 14.0000 16.0000

CHANGING TEST DATA 3 TITLE

NO. OF POINTS = 10  
BEST FIT =

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

The next time the screen is cleared (i.e. by calling REVE again) the new title will appear at the top of the viewing axis.

## CHANGING TEST DATA 3 TITLE

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEW

DISP

REST

REVE

SPEC

HARD

CHAN

PUNC

END

		16.0000	14.0000	12.0000	POLYNOMIAL/EMPIRICAL	1ST	1	10.0000	X	8.0000	X	X	X	X	X	X	X	X	X	4.0000	2.0000	X	X	0.0000	0.0000	2.0000	4.0000	6.0000	8.0000	10.0000	12.0000	14.0000	16.0000
2ND	2					2ND	2																										
3RD	3					3RD	3																										
4TH	4					4TH	4																										
5TH	5					5TH	5																										
6TH	6					6TH	6																										
7TH	7					7TH	7																										
8TH	8					8TH	8																										
9TH	9					9TH	9																										
10TH						10TH																											
11TH						11TH																											

NO. OF POINTS = 10  
BEST FIT =

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

RESCALE AXES

If the addition of points causes points to lie outside the viewing axis, it would be beneficial to select the phrase RESCALE AXES or RESC and have these points scaled into the viewing area. First select the phrase RESCALE AXES or RESC.

## CHANGING TEST DATA 3 TITLE

16.0000

14.0000

POLYNOMIAL/EMPIRICAL

	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH	10TH	11TH
12.0000	1	2	3	4	5	6	7	8	9	10	11
	10.0000			8.0000	6.0000	4.0000	2.0000				
	x			x	x	x	x				

0.0000 0.0000 1.0000 2.0000 3.0000 4.0000 5.0000 6.0000 7.0000 8.0000 9.0000 10.0000 11.0000 12.0000 13.0000 14.0000 15.0000

NO. OF POINTS = 10 12  
BEST FIT .

0.0000 0.0000 1.0000 2.0000 3.0000 4.0000 5.0000 6.0000 7.0000 8.0000 9.0000 10.0000 11.0000 12.0000 13.0000 14.0000 15.0000

END

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.END OF LINE  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
-1,-1,20,20,

The screen will clear and all of the data points  
will be scaled to nicely fit into the viewing area.

## CHANGING TEST DATA 3 TITLE

## OPTIONS

READ  
RESC  
S-L.  
D CV  
D PT  
ADD  
ORIG  
NEU  
DISP  
REST  
REVE  
SPEC  
HARD  
CHAN  
PUNC  
END

POLYNOMIAL/EMPIRICAL	20.0000	X
1ST	1	
2ND	2	16.0000
3RD	3	
4TH	4	12.0000
5TH	5	
6TH	6	8.0000
7TH	7	
8TH	8	4.0000
9TH	9	
10TH		0.0000
11TH		X
		-4.0000
		-4.0000
		4.0000
		8.0000
		12.0000
		16.0000
		20.0000
		24.0000

NO. OF POINTS = 12  
BEST FIT =

## CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

SPECIFY CONSTANTS

In order to experiment on any empirical equation selected to fit the data, select the phrase SPECIFY CONSTANTS or SPEC. Any and all of the calculated curve constants may be varied to see their resultant effect.

## TEST DATA 3

16.0000

## POLYNOMIAL/EMPIRICAL

	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH
14.0000									
12.0000									
10.0000	1	2	3	4	5	6	7	8	9
8.0000									
6.0000									
4.0000									
2.0000									
0.0000									

83

	10TH	11TH
2.0000	9	
1.0000		
0.0000		

NO. OF POINTS = 10  
BEST FIT .

END

## CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

## OPTIONS

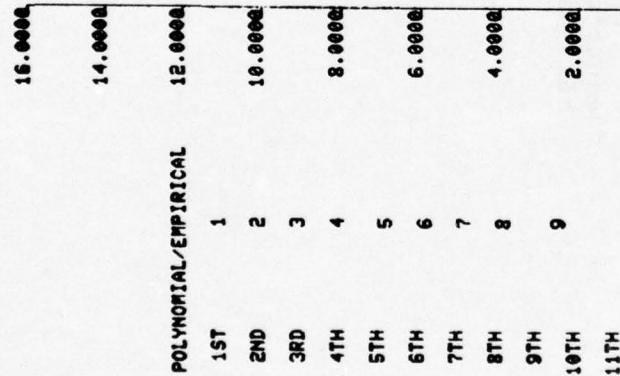
READ      RESC      S-L      D CU      D PT      ADD      ORIG      NEU      DISP      REST      REUE      SPLO

The first task for SPECIFY CONSTANTS is to obtain the empirical equation that will be worked on. The program asks WHICH CURVE WOULD YOU LIKE TO WORK ON.

## TEST DATA 3

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEU  
DISP  
REST  
REUE  
SPEC  
HARD  
CHAN  
PUNC  
END



NO. OF POINTS = 10  
BEST FIT =

CURVE  
 A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE  
 COEFFICIENT OF  
 DETERMINATION

WHICH CURVE WOULD YOU LIKE TO WORK ON

Now, select a curve from the list of empirical equations and SPECIFY CONSTANTS will calculate the curve and its results.

## TEST DATA 3

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEU

DISP

REST

REVE

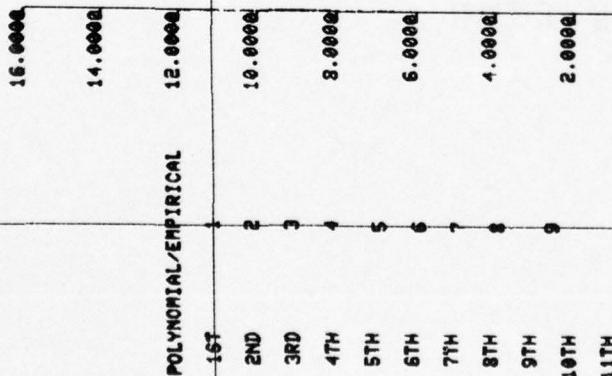
SPEC

HARD

CHAN

PUNC

END

NO. OF POINTS = 10  
BEST FIT .

## CURVE

A =

B =

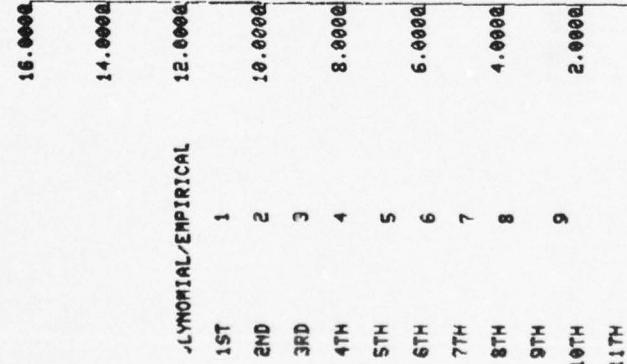
C =

STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

WHICH CURVE WOULD YOU LIKE TO WORK ON

After the curve and its statistical results appear, additional information is displayed. On the bottom left is the calculated values for the curve constants; in the bottom center are three phrases for determining SPECIFY CONSTANTS program flow (DONE, DISPLAY, and ENTER), and on the bottom right is the input area for modifying the constants.

## TEST DATA 3



NO. OF POINTS = 10  
BEST FIT = 1

C0

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEU

DISP

REST

REUE

SPEC

HARD

CHAN

PUNC

END

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE. NEXT  
PICK DONE, DISPLAY, OR ENTER

CURVE 1  
A = .4333  
B = .9758  
C =  
STAND. ERROR  
OF ESTIMATE = .9247  
COEFFICIENT OF  
DETERMINATION = .9918

DONE

DISPLAY

ENTER WHICH CURVE WOULD YOU LIKE TO WORK ON

AD-A031 854

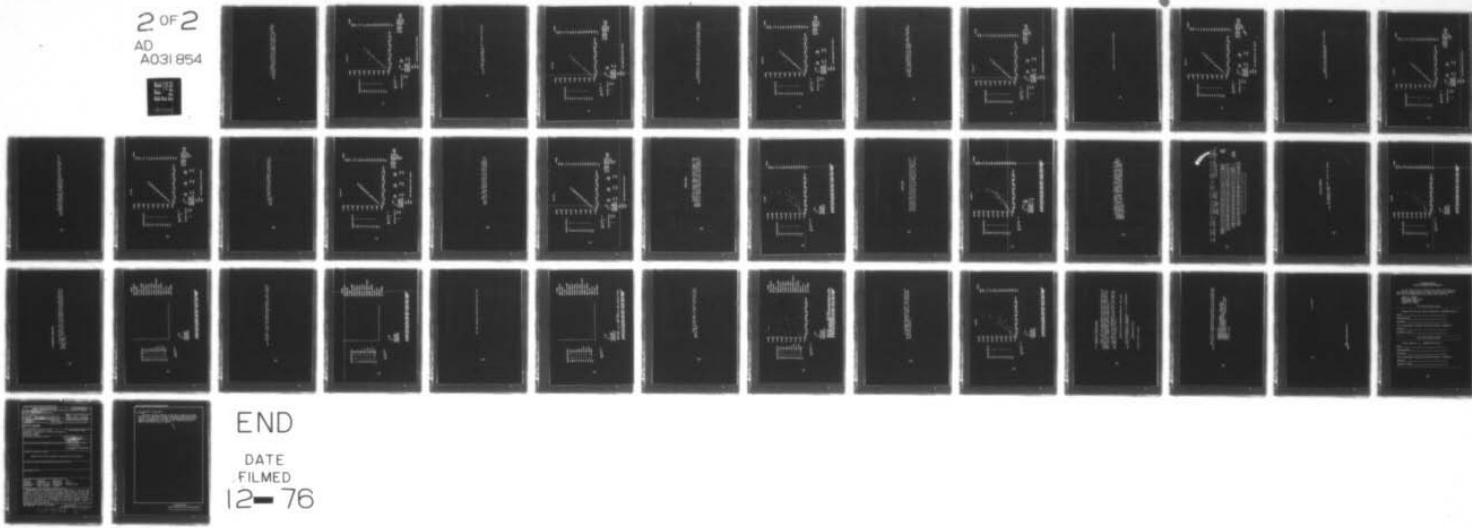
PICATINNY ARSENAL DOVER N J MANAGEMENT INFORMATION S--ETC F/G 9/2  
GRAFTEK - GRAFFIT CURVE FITTING PROGRAM TEKTRONIX VERSION.(U)

SEP 76 W D LUNGER  
MISD-UM-76-3

UNCLASSIFIED

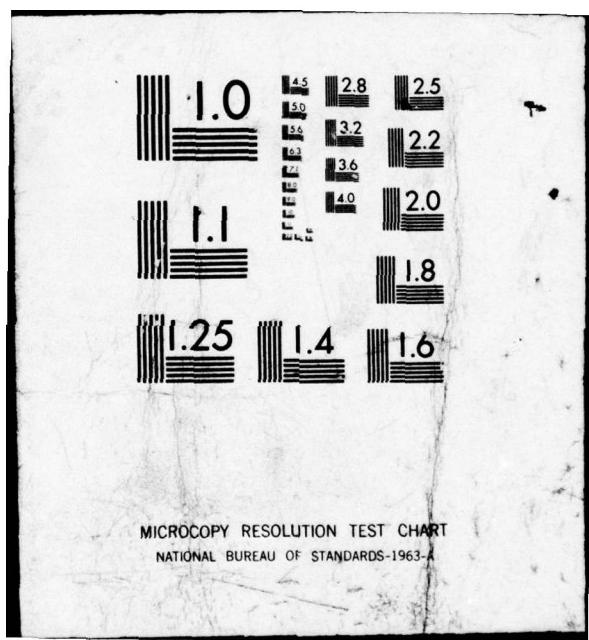
2 OF 2  
AD  
A031 854

NL



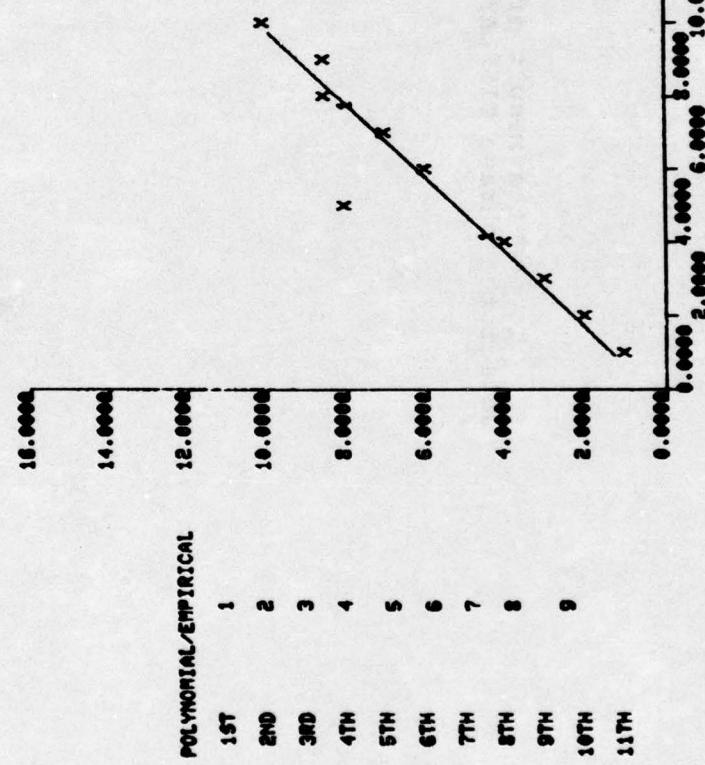
END

DATE  
FILED  
12-76



To change a constant, type the desired constant letter followed by its new numeric value. When input is complete, depress the keyboard return key.

## TEST DATA 3



NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR

CURVE	A	B	C
1	.4333	.9753	
2			

STAND. ERROR  
OF ESTIMATE = .9947  
COEFFICIENT OF  
DETERMINATION = .9918

DONE  
DISPLAY  
ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

## OPTIONS

REJO  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
NEU  
DISP  
REST  
RELU  
SPEC  
HARD  
CHAN  
PUNC  
END

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
-01.0000

To see the result of the altered constant,  
select the phrase DISPLAY.

## TEST DATA 3

OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEW

DISP

REST

REV

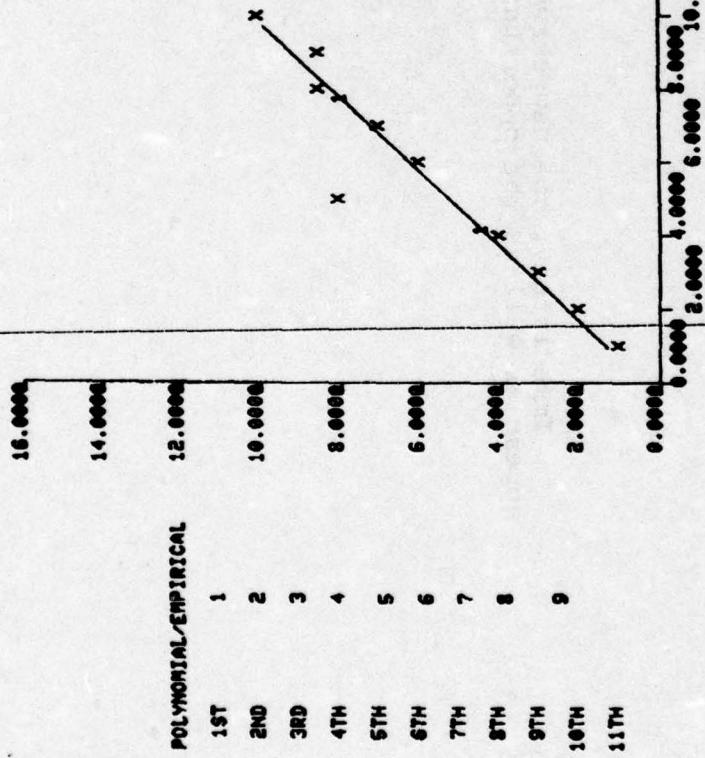
SPEC

HARD

CHAN

FUNC

END

NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR

CURVE	A	B	C
1	.4333	.9758	
			STAND. ERROR
			OF ESTIMATE .9847
			COEFFICIENT OF DETERMINATION .9918

DONE

DISPLAY

ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

TO CHANGE A CONSTANT -  
 TYPE LETTER THEN VALUE. NEXT  
 PICK DONE, DISPLAY, OR EDIT  
 -01.0000

Immediately, the new curve and its statistical results appear as well as the opportunity to change another constant.

## TEST DATA 3

OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

HEU

DISP

REST

REVE

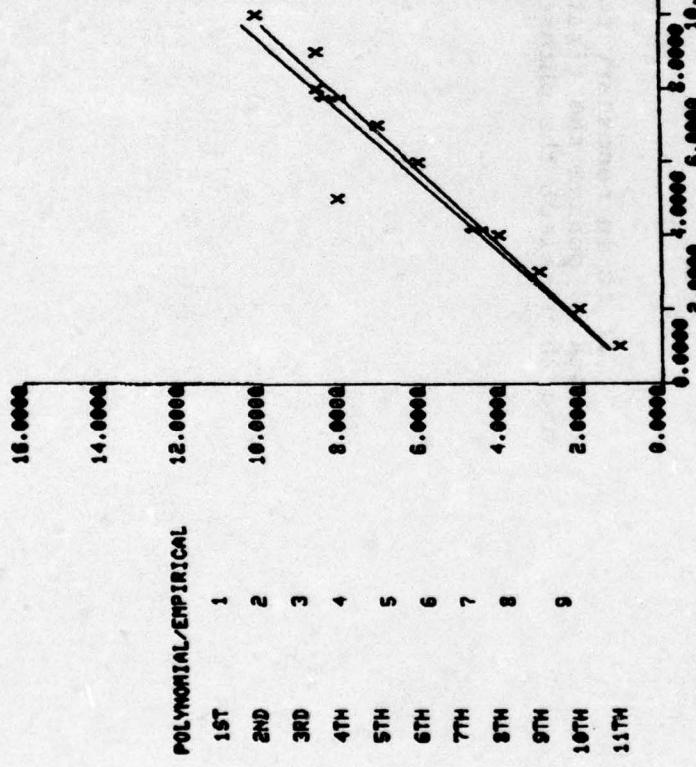
SPEC

HARD

CHAN

PLNC

END

NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR

	CURVE	A	B	C
A	.4333	.4333	.4333	.4333
B	.9758	.9758	.9758	.9758
C				1.0359
STAND. ERROR				
OF ESTIMATE				
COEFFICIENT OF				
DETERMINATION				
		.9847	.9729	
		.9918	1.0038	

DONE

DISPLAY

ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
"S1.000"

If it is necessary to change more than one constant, change the first as previously described and then select the phrase ENTER.

## TEST DATA 3

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

HEU

DISP

REST

REUE

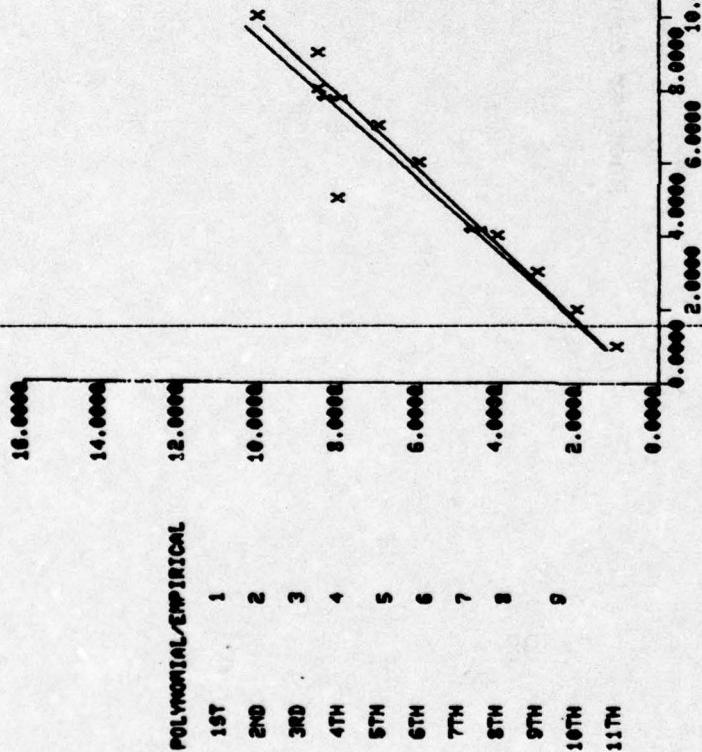
SPEC

HARD

CHAN

PUNC

END



CALCULATED VALUE FOR  
CURVE 1  
A = .4333  
B = .9758  
C = .0250

NO. OF POINTS = 10

BEST FIT = 1

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
\*31.000  
\*31.0

CURVE 1  
A = .4333  
B = .9758  
C = .0250  
STAND. ERROR  
OF ESTIMATE .9247  
COEFFICIENT OF  
DETERMINATION .9918  
1.0036

DONE

DISPLAY

ENTER WHICH CURVE WOULD YOU LIKE TO WORK ON  
CURVE 1

Another constant can now be changed.

## TEST DATA 3

OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

DISP

REST

RELE

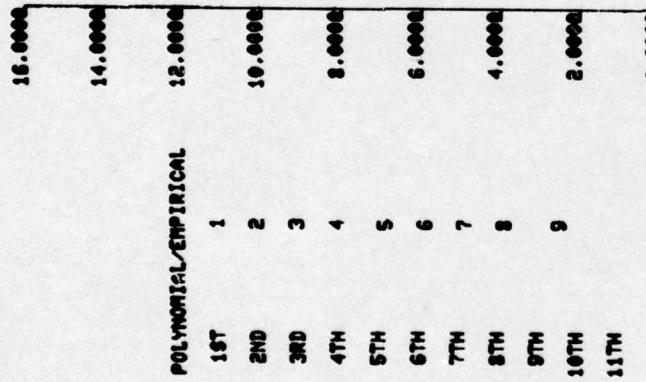
SPEC

HARD

CHAN

PUNC

END



NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR  
A : .4333  
B : .9758  
C :

CURVE	A	B	C
1	.4333	.9758	1.0036
2			

STAND. ERROR  
OF ESTIMATE: .9247  
COEFFICIENT OF DETERMINATION: .9913

DONE

DISPLAY

ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
•81.665  
•31.0

When all the constants have been changed,  
again select the phrase DISPLAY.

## TEST DATA 3

## OPTIONS

READ

RESC

S-L

D CU

D PT

ADD

ORIG

NEW

DISP

REST

REUE

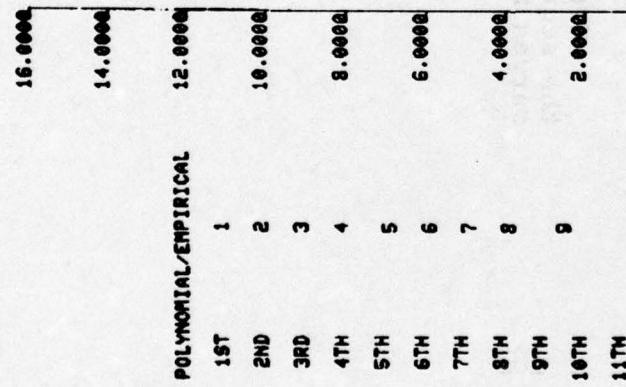
SPEC

HARD

CHAN

PUNC

END

NO. OF POINTS = 11  
BEST FIT = 1

CALCULATED VALUE FOR

A	.4333	CURVE	1	1
B	.9758	A -	.4333	.4333
C		B -	.9758	1.0250
		C -		

DONE

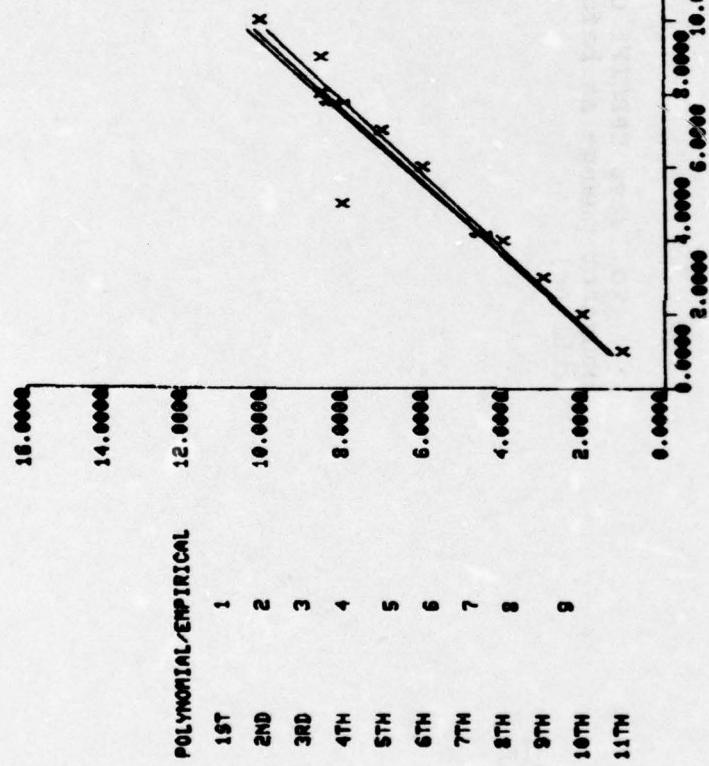
TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER

*B1.025
*B1.0
*A.5

DISPLAY    WHICH CURVE WOULD YOU LIKE TO WORK ON  
ENTER

The new curve and its statistical results display and the sequence continues. Remember, however, that only 3 curves may be displayed at one time.

## TEST DATA 3



NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR  
CURVE 1  
A = .4333  
B = .9758  
C = .0250

STAND. ERROR  
OF ESTIMATE = .9347  
COEFFICIENT OF  
DETERMINATION = .9018

DONE

DISPLAY

ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

## OPTIONS

READ  
RESC  
S-L  
D CU  
D PT  
ADD  
ORIG  
HELI  
DISP  
REST  
REFE  
SPEC  
HARD  
CHAN  
PUNC  
END

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
\*31.925  
-31.0  
-41.5

CURVE 1  
A = .4333  
B = .9758  
C = .0250  
1  
.5000  
1.0000

1  
.5000  
1.0000

To leave SPECIFY CONSTANTS, first make a constant change as before (any arbitrary value will do).

## TEST DATA 3

## OPTIONS

READ

RESC

S-L

D CV

D PT

ADD

ORIG

HELI

DISP

REST

RELE

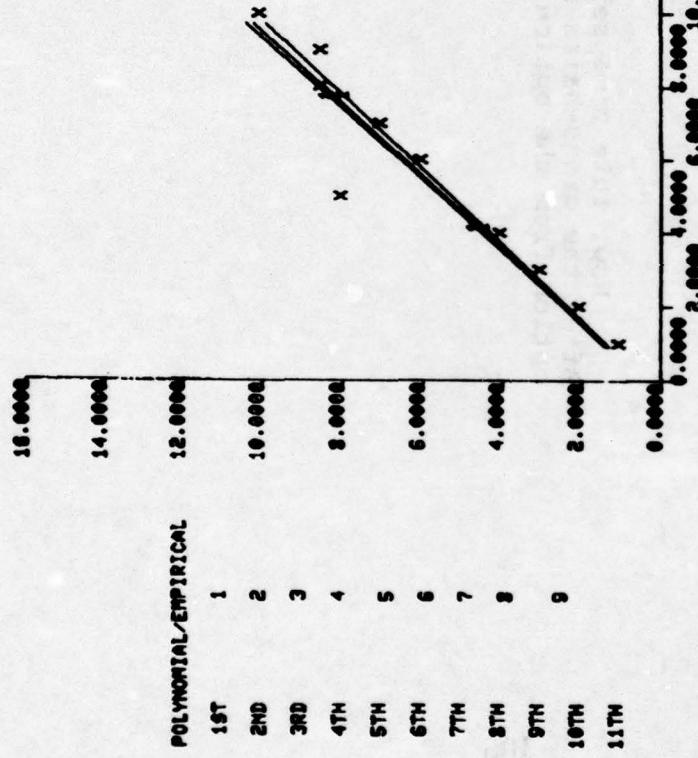
SPEC

HARD

CHAN

FUNC

END



TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE. NEXT  
PICK DONE, DISPLAY, OR ENTER

\*31.000  
\*31.0

\*0.5

\*0.0

	CURVE	A	B	C	A	B	C
1		.4333	.9758		.4333	.9758	
2					1.0000	1.0000	1.0000
3							

A = .4333  
B = .9758  
C = STAND. ERROR  
OF ESTIMATE = .9247  
COEFFICIENT OF  
DETERMINATION = .9918

A = .4333  
B = .9758  
C = .9739  
.9497  
1.0036  
.9618

DONE

DISPLAY

ENTER

WHICH CURVE WOULD YOU LIKE TO WORK ON

Now, this time select the phrase DONE.  
After the cross-hairs return to the screen any  
option from the option list may be selected.

## TEST DATA 3

## OPTIONS

READ    RESC    S-L    D CU    D PT    ADD    ORIG    NEU    REST    REVIE    SPEC    HARD    CHAN    PUNC

END

16.0000

14.0000

12.0000

10.0000

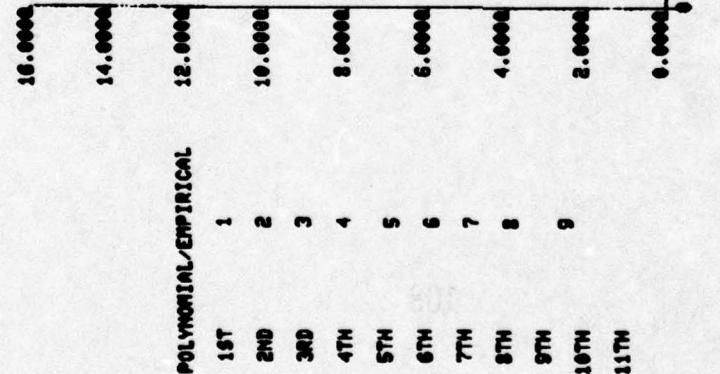
8.0000

6.0000

4.0000

2.0000

0.0000



NO. OF POINTS = 10  
BEST FIT = 1

CALCULATED VALUE FOR

CURVE

STAND. ERROR

OF ESTIMATE

COEFFICIENT OF

DETERMINATION

PICK

DONE

DISPLAY

ENTER

RESC

S-L

D CU

D PT

ADD

ORIG

NEU

REST

REVIE

SPEC

HARD

CHAN

PUNC

END

TO CHANGE A CONSTANT -  
TYPE LETTER THEN VALUE, NEXT  
PICK DONE, DISPLAY, OR ENTER  
 \*81.935    .911.0    .91.5  
 .909.

A :	.4333	1	.4333	1
B :	.9758		.9758	.9758
C :				1.0000

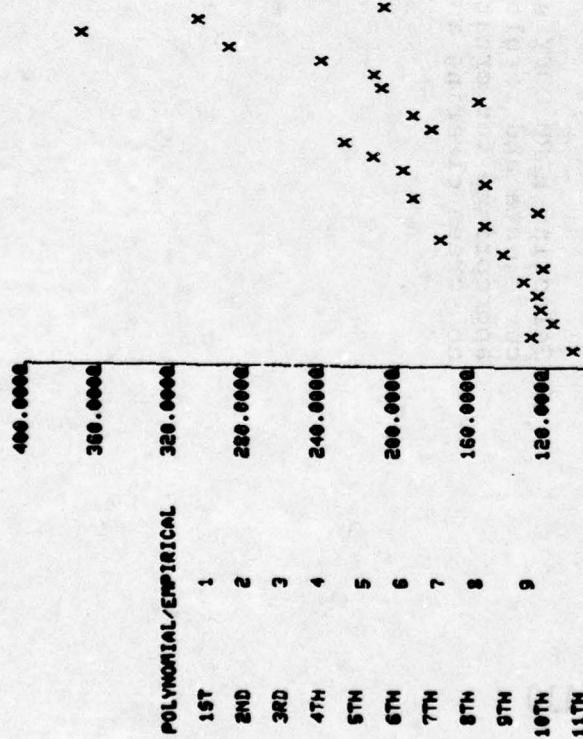
STAND. ERROR	.9739	.9497
OF ESTIMATE	.9247	
COEFFICIENT OF		.9497
DETERMINATION	.9018	.9518

SOME    DISPLAY    WHICH CURVE WOULD YOU LIKE TO WORK ON  
ENTER

PUNCH DECK

To obtain a punch deck of the current data set, select the phrase PUNCH DECK or PUNC. All punch decks are queued until the completion of GRAF-TEK at which time they are all punched out. There is no screen change during this process.

## PICTINITY



NO. OF POINTS = 28  
BEST FIT =

## CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

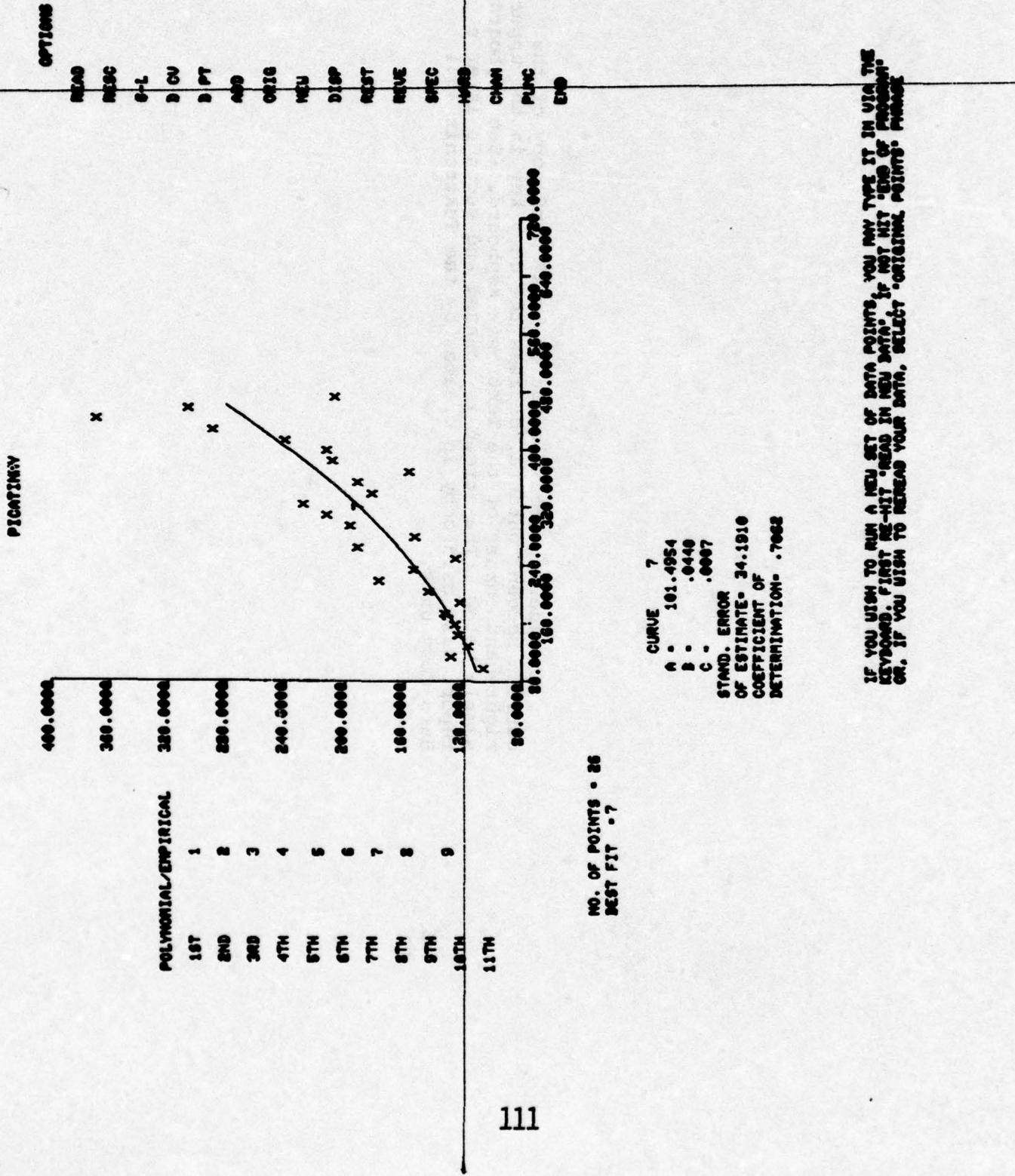
OPTIONS

PIED MISC S-L D CU D PT AND ORIG PLOT DISP REST RELE SPEC HEND CHAN PUNC

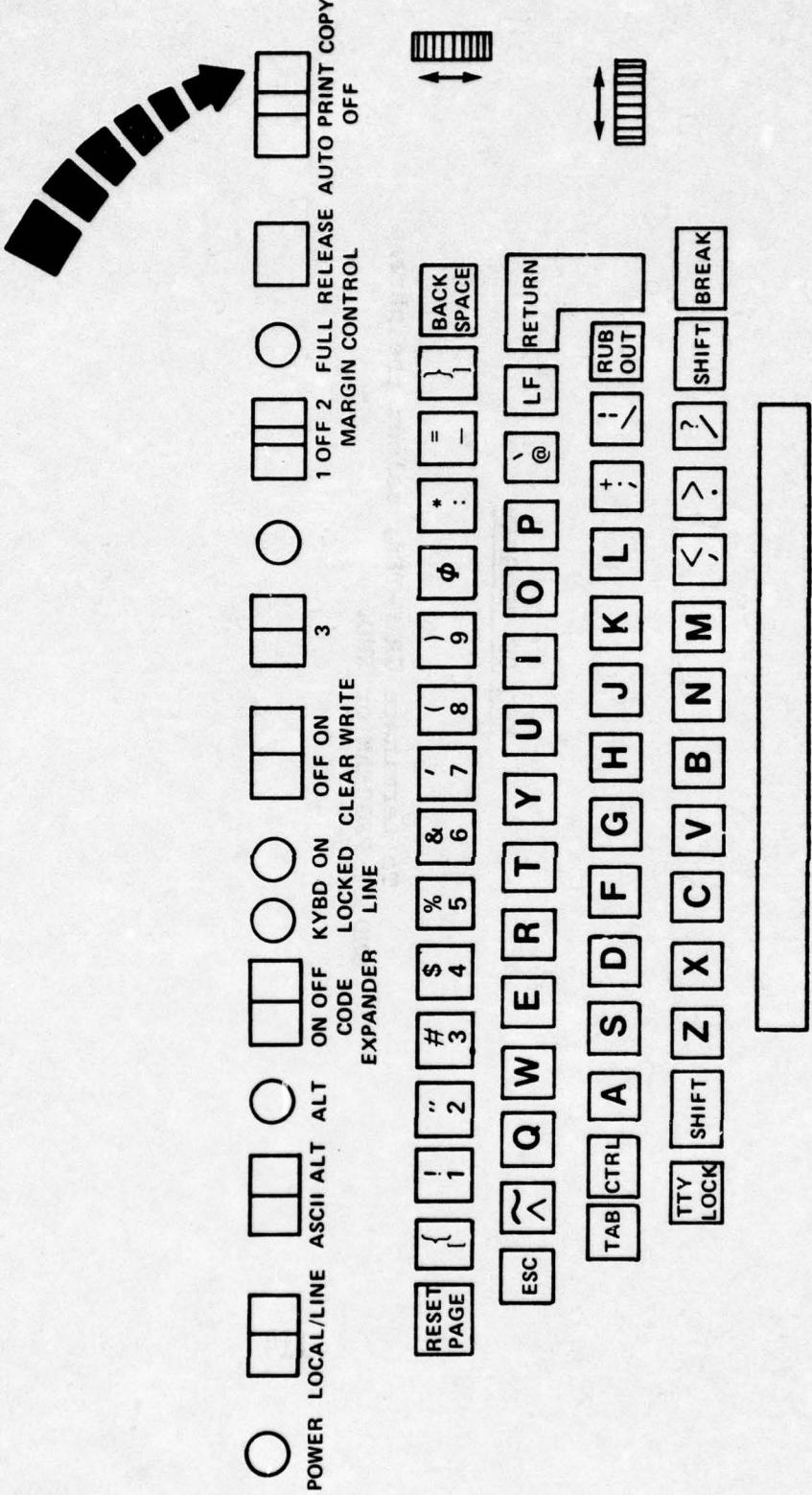
IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
KEYBOARD. FIRST RE-TIT "READ IN NEW DATA". IF NOT HIT "END OF PROGRAM".  
OR, IF YOU WISH TO READ IN YOUR DATA, SELECT "ORIGINAL POINTS". PLEASE

HARD COPY

Selecting HARD COPY saves all of the last displayed curve data and results onto a disk file which is appropriate for creating a CALCOMP plot. There is no screen clearing and normal program flow continues.



In order to obtain a "quick look" hard copy of the current screen contents, depress the copy key in the upper right-hand corner of the Tektronix keyboard. (See keyboard sample below). The screen is scanned and seconds later a report size hard copy is created by the Tektronix 4631 Hard Copy Unit.



END OF PROGRAM

To terminate GRAF-TEK, select the phrase  
**END OF PROGRAM or END.**

POLYNOMIAL

400.0000

360.0000

320.0000

280.0000

240.0000

200.0000

160.0000

120.0000

80.0000

40.0000

0.0000

OPTIONS

READ REC S-L D CP D RT END ORIG NLU DISP REST RUE SPEC HNDL CHAN FUNC END



400.0000  
360.0000  
320.0000  
280.0000  
240.0000  
200.0000  
160.0000  
120.0000  
80.0000  
40.0000  
0.0000

NO. OF POINTS = 26  
BEST FIT =

CURVE

A =

B =

C =

STAND. ERROR  
OF ESTIMATE =  
COEFFICIENT OF  
DETERMINATION =

IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
KEYBOARD. FIRST RE-HIT 'READ' IN NEW DATA, IF NOT HIT 'END' OR  
ON. IF YOU WISH TO REREAD YOUR DATA, SELECT 'ORIGINAL POINTS' FROM

V. CREATING A DATA SET

If all the data sets are exhausted or GRAF-TEK begins with no data file at all, the following display occurs. To create data, follow the instructions at the bottom of the display area.

## POLYNOMIAL/EMPIRICAL

1ST 1 Y = A+BX  
 2ND 2 Y = AX<sup>2</sup>  
 3RD 3 Y = AE<sup>BX</sup>  
 4TH 4 Y =  $\frac{X}{A+BX}$   
 5TH 5 Y = AX<sup>B-C</sup>  
 6TH 6 Y = AE<sup>BX+C</sup>  
 7TH 7 Y = A+BX+CX<sup>2</sup>  
 8TH 8 Y =  $\frac{X}{A+BX+C}$   
 9TH 9 Y = AE<sup>BX+CX<sup>2</sup>  
 10TH E = 2.7182818  
 11TH</sup>

NO. OF POINTS •  
 BEST FIT "

CURVE  
 A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE.  
 COEFFICIENT OF  
 DETERMINATION.

OPTIONS  
 READ IN NEW DATA  
 RESCALE AREA  
 S-L FORM  
 DELETE ALL CURVES  
 DELETE POINT(S)  
 ADD NEW POINT(S)  
 ORIGINAL POINTS  
 NEW PTS. NOU ORG.  
 DISPLAY A CURVE  
 RESTORE DELETED POINT(S)  
 REVERSE X AND Y  
 SPECIFY CONSTANTS  
 HARD COPY  
 CHANGE TITLE  
 PUNCH DECK  
 END OF PROGRAM

IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
 KEYBOARD. FIRST RE-HIT "READ IN NEW DATA". IF NOT HIT "END OF PROGRAM".  
 OR, IF YOU WISH TO REREAD YOUR DATA, SELECT "ORIGINAL POINTS". PLEASE

To type in via the Tektronix keyboard - just like ADD  
NEW POINT(S), select the phrase READ IN NEW DATA or READ.

POLYNOMIAL/EMPIRICAL

1ST	1	$y = A + BX$
2ND	2	$y = Ax^2$
3RD	3	$y = Ax^3$
4TH	4	$y = Ax^4$
5TH	5	$y = Ax^5 + C$
6TH	6	$y = Ax^6 + C$
7TH	7	$y = Ax^7 + Cx^2$
8TH	8	$y = Ax^8 + C$
9TH	9	$y = Ax^9 + Cx^2$
10TH	E	$E = 2.7182818$
11TH		

NO. OF POINTS •  
BEST FIT •

CURVE  
A -  
B -  
C -  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

### OPTIONS

ADD NEW DATA  
RESCALE DATA  
S-L FORM  
DELETE ALL CURVES  
DELETE POINT(S)  
ADD NEW POINT(S)  
ORIGINAL POINTS  
NEW PTS. NEW ONE.  
DISPLAY A CURVE  
RESTORE DELETED POINT(S)  
REVERSE X AND Y  
SPECIFY CONSTANTS  
HARD COPY  
CHANGE TITLE  
PUNCH DECK  
END OF PROGRAM

IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
KEYBOARD. FIRST SET HIT 'READ' IN NEW DATA. IF NOT HIT 'END'. OR, IF YOU  
WISH TO RETEAD YOUR DATA, SELECT 'ORIGINAL POINTS'. PLEASE

The ADD inputting technique should be used.

## POLYNOMIAL/EMPIRICAL

1ST 1  $y = A+Bx$   
 2ND 2  $y = Ax^2$   
 3RD 3  $y = Ax^3$   
 4TH 4  $y = Ax^4$   
 5TH 5  $y = Ax^5 + C$   
 6TH 6  $y = Ax^6 + C$   
 7TH 7  $y = A+Bx+Cx^2$   
 8TH 8  $y = Ax^8 + C$   
 9TH 9  $y = Ax^9 + Cx^2$   
 10TH E = 2.7182818  
 11TH

NO. OF POINTS =  
BEST FIT =

CURVE  
 A =  
 B =  
 C =  
 STAND. ERROR  
 OF ESTIMATE.  
 COEFFICIENT OF  
 DETERMINATION.

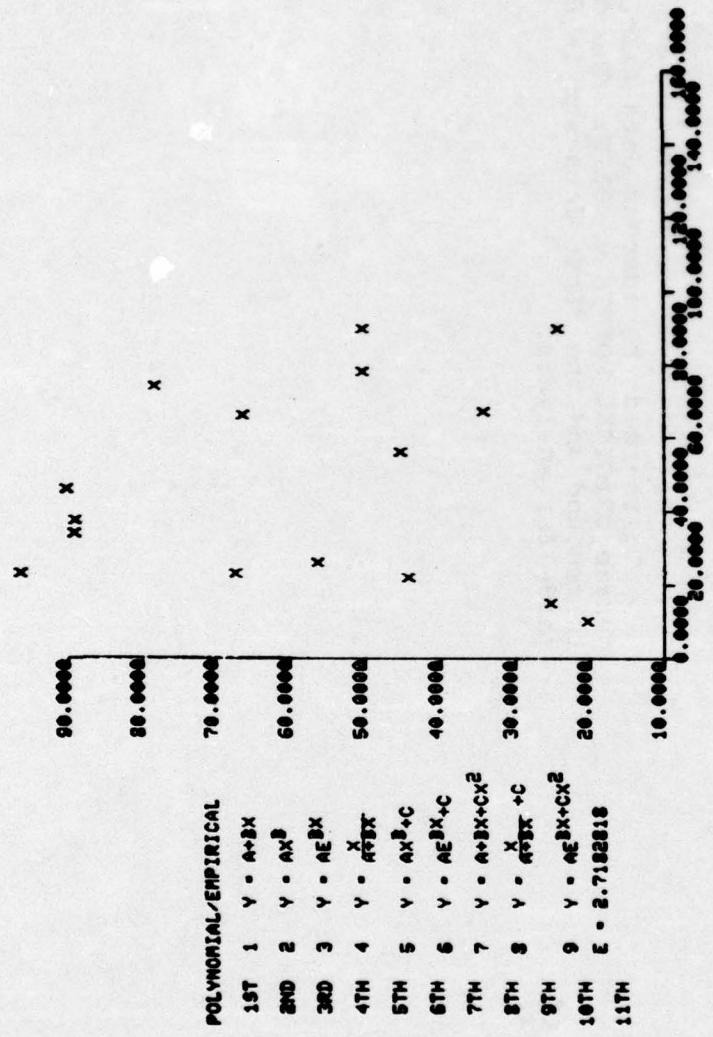
END OF DATA  
 PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.

IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
 KEYBOARD. FIRST RE-HIT "READ IN NEW DATA" IF NOT HIT "END OF PROGRAM".  
 SELECT "ORIGINAL POINTS". PLEASE  
 READING YOUR DATA. SELECT "ORIGINAL POINTS". PLEASE  
 READING YOUR DATA.

## OPTIONS

READ IN NEW DATA  
 RESCALE DATA  
 S-L FORM  
 DELETE ALL CURVES  
 DELETE POINT(S)  
 ADD NEW POINT(S)  
 ORIGINAL POINTS  
 NEW PTS. NOU ORG.  
 DISPLAY A CURVE  
 RESTORE DELETED POINT(S)  
 REVERSE X AND Y  
 SPECIFY CONSTANTS  
 WORD COPY  
 CHANGE TITLE  
 PUNCH DECK  
 END OF PROGRAM

Type in the data - for more than one line  
select the phrase END OF LINE - and then select  
END OF DATA.



OPTIONS  
READ IN NEW DATA  
RESCALE AXES  
S-L FORM

DELETE ALL CURVES  
DELETE POINT(S)  
ADD NEW POINT(S)  
ORIGINAL POINTS  
NEW PTS. NOT ORG.  
RESTORE DELETED POINT(S)  
DISPLAY A CURVE  
REVERSE X AND Y  
SPECIFY CONSTANTS  
HARD COPY  
CHANGE TITLE  
PUNCH DECK  
END OF PROGRAM

END OF DATA  
END OF LINE  
PLEASE TYPE IN X AND Y COORD. IN PAIRS EACH NUMBER FOLLOWED BY A COMMA.  
10.29, 15.25, 39.59, 59.82, 67.70, 59.37, 15.88, 82.36, 82.34, 89.84, 45.67, 34.83, 37.17,  
48.44, 66.68, 74.70, 46.90, 56.14, DATA POINTS, YOU MAY TYPE IT IN VIA THE  
KEYBOARD. FIRST RE-HIT 'READ IN NEW DATA'. IF NOT HIT 'END OF PROGRAM'  
OR, IF YOU WISH TO RECALL YOUR DATA, SELECT 'ORIGINAL POINTS'. PLEASE

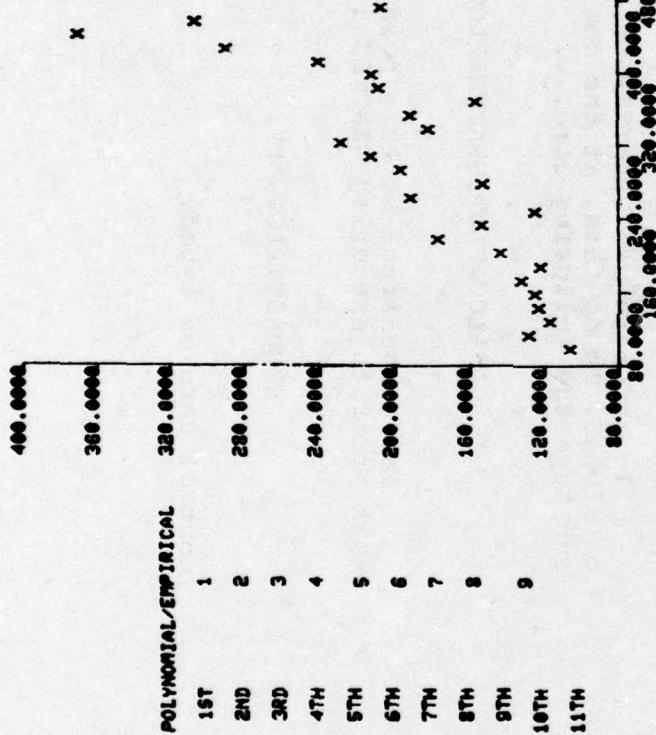
CURVE  
A -  
B -  
C -  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

To re-read the current data file select the phrase ORIGINAL POINTS or ORIG. The data file is rewound and the first data set is displayed, ready for analysis.

PICATINNY

OPTIONS

READ  
RESC  
S-L  
D CV  
D PT  
ADD  
ORIG  
NEW  
DISP  
REST  
REUS  
SPEC  
HARD  
CHAN  
PUNC  
END



NO. OF POINTS = 26  
BEST FIT =

CURVE

A =  
B =  
C =  
STAND. ERROR  
OF ESTIMATE.  
COEFFICIENT OF  
DETERMINATION.

IF YOU WISH TO RUN A NEW SET OF DATA POINTS, YOU MAY TYPE IT IN VIA THE  
KEYBOARD. FIRST RE-HIT "READ" IN NEW DATA. IF NOT HIT 'ONE' OR 'NONE'  
OR, IF YOU WISH TO READ YOUR DATA, SELECT 'ORIGINAL POINTS' FROM

#### VI. CREATING A CALCOMP PLOT

Every time the user selects the phrase HARD COPY the last curve and its statistical results are stored onto a computer disk file called PLOT. This file, when used as data for the GRAFTEKPLOT program produces a CALCOMP drum plot having a graph for each of these curves.

In order to use GRAFTEKPLOT, the PLOT file must be catalogued. To do this, at the completion of the GRAF-TEK run type the following card....

CATALOG,PLOT,GRAFTEKPLOTDATA, ID= user name.

For convenience at this point, it is recommended that prior to executing GRAFTEK a

REQUEST,PLOT,\*PF.

control card be typed.

When PLOT is successfully catalogued, run the following control cards via BATCH to produce the desired CALCOMP plot.

```
GRAFPLOT,NTL.  
COMMENT.(XXX-YYY>NNNNNL), user name  
ATTACH,GPLOT,GRAFTEKPILOT, ID=MISDSEAD.  
ATTACH,PLOT,GRAFTEKPILOTDATA, ID= user name.  
REQUEST,TAPE77,NT,S. PLOT/user name  
GPLOT.  
6-7-8-9 Card
```

END OF GRAF-TEK

STOP : 882 CP SECONDS EXECUTION TIME  
COMMAND -

GRAFTEK ROUTINE  
UPDATE SUBSCRIPTION SERVICE

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MISD/SEAD BLDG. 353S.  
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) GRAFTEK is an interactive graphics program that fits by least squares, a curve to N data points. This code combines two CDC 274 graphics curve fitting programs (GRAFFIT, LSQ) for use on the TEKtronix 4014 storage tube using Tektronix software (TCS). The program fits the curve and determines the constants for any of nine empirical equations or a polynomial of up to 11th degree, and displays the fitted curve (up to three at one time) against a background of the data points.		

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over 407641 *[Signature]*

20. Abstract (continued)

Options include reading in new data, rescale of axes, deleting all displayed curves, deleting points, adding new points, restoring all original or selected deleted points, specifying constants, and calling for CALCOMP plotter or "quick look" hard copy of output.

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